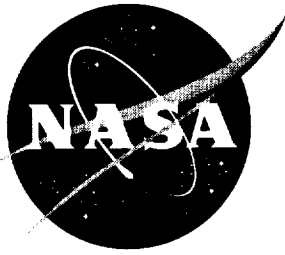


NASA/CR-2002-211234



2001 NASA-ODU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program

Compiled by:

*Surendra N. Tiwari
Old Dominion University, Norfolk, Virginia*

*Deborah B. Murray
Old Dominion University, Norfolk, Virginia*

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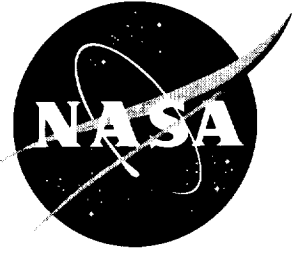
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National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia 23681-2199

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SECTION 1

ORGANIZATION AND MANAGEMENT

The 2001 Old Dominion University (ODU)-NASA Langley Research Center (LaRC) Summer Faculty Fellowship Research Program, the thirty-seventh such institute to be held at LaRC, was planned by a committee consisting of the University Co-Director, LaRC Administrative Officers (AOs) from the research Competencies and Program Offices, and the Office of Education.

An initial assessment of each applicant's credentials was made by the University Co-Director and the NASA LaRC University Affairs Officer. The purpose of this assessment was to ascertain to which Competency the applicant's credentials should be circulated for review. Once this determination was made, an application distribution meeting was scheduled with the AOs where applications were distributed and instructions concerning the selection process were discussed. At a later date, the AOs notified the ASEE office of the selections made within their Competency or Program Office.

The Program Manager then contacted each selected Fellow by phone extending the individual a verbal appointment, which was followed up with a formal letter of confirmation. Individuals were given ten days to respond in writing to the appointment. Once the letters of acceptance were received, a roster was sent to each AO advising them of their Fellows for the summer program.

Fellows accepting the appointment were provided with material relevant to housing, travel, payroll distribution, and the orientation. Each Fellow, in advance of commencing the program, was contacted by his or her Research Associate or representative of the branch.

Each Fellow and Research Associate received a 2001 ASEE Policies, Practices, and Procedures Manual that clarified many commonly asked questions up front regarding the roles, responsibilities, policies, and procedures of both parties. This manual was very beneficial and will be updated annually to be used in the years to come (Appendix IX).

At the Orientation meeting, Mr. Edwin J. Prior, Deputy Director, Langley Office of Education, provided a welcome on behalf of Dr. Samuel E. Massenberg, Director, Office of Education, and presented an overview of Langley Research Center. Introductions of the Administrative Staff and a program overview were presented by Mr. Roger A. Hathaway, University Affairs Officer. Mr. James R. Hall provided a security briefing followed by a presentation on Export Control and Information Protection provided by Mr. Samuel L. Capino, LaRC's Center Export Administrator. A Health Briefing was provided by Dr. Leroy P. Gross. An Information Technology Security Briefing was given by Mr. Geoffrey M. Tennille, Information Technology Security Manager for LaRC. Following a short break, a program breakout session was next on the agenda, enabling the ASEE administrative staff (Dr. Surendra N. Tiwari-ASEE Co-Director,

and Mrs. Debbie Murray-ASEE Program Manager) to meet with the 2001 Fellows to discuss administrative procedures and answer questions. Following the breakout session, the Fellows were greeted by their LaRC Associates who then escorted them to their respective work sites. An evaluation of the orientation meeting was completed (Appendix VIII).

Throughout the program, the University Co-Director served as the principal liaison person and had frequent contacts with the Fellows. The Program Manager worked closely with the ASEE Co-Director in the administration of the program, and acted as his representative in his absence. Site visits were conducted with selected Fellows and their NASA Associates to discuss the success of the project, as well as any concerns.

At the conclusion of the program, each Fellow submitted an abstract describing his/her accomplishments (Appendix VII). Each Fellow gave a talk on his/her research within the Competency. The Competency AOs then forwarded to the Co-Director the names of the Fellows recommended within their Competencies for the Final Presentations. Eight excellent papers were presented to the Fellows, Research Associates, and invited guests. For the seventh year, the presentations were judged by a panel of LaRC researchers for "The Best Research Presentation" competition (Appendix II). The Final Presentations were concluded with a luncheon at the Langley Air Force Base Officer's Club where the winner was announced and presented with a certificate and invitation to return to LaRC for a visit during the academic year. Dr. Richard Louie with Pacific Lutheran University was the winner for the 2001 competition.

Each Fellow and Research Associate was asked to complete a questionnaire provided for the purpose of evaluating the summer program (Section VI).

SECTION II

RECRUITMENT AND SELECTION OF FELLOWS

Returning Fellows

An invitation to apply and possibly participate in the Old Dominion University (ODU)-NASA Langley Research Center (LaRC) Program was extended to the individuals who held 2000 fellowship appointments and were eligible to participate for a second year. Out of the individuals responding to the invitation, thirteen accepted offers of appointment (Table 1). Five Fellows from previous years accepted offers of appointment.

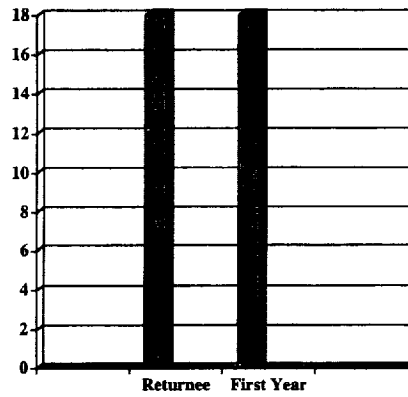
First Year Fellows

For the 2001 program, ASEE Headquarters once again provided a web site for the summer program application materials in lieu of brochures being mailed out. Many personal contacts to deans and department heads of various engineering schools in the East, South, and Midwest, were made by Dr. William P. Marable of Hampton University (HU) and Dr. Surendra N. Tiwari of Old Dominion University (ODU) requesting their assistance in bringing to the attention of their faculties the ODU-HU-NASA LaRC program. In addition to the above, a number of departments of chemistry, physics, computer science, and mathematics at colleges (including community colleges and minority institutions) and universities in the state of Virginia, as well as, neighboring states were contacted regarding this program (Table 2). Additional recruiting efforts included either attendance at or providing information for several of the minority and majority conferences, as well as, Video Teleconferences hosted by this staff. These efforts resulted in a total of sixty-four formal applications indicating the ODU-HU-NASA LaRC program as their first choice, and a total of seven applications indicating the aforementioned as their second choice. The total number of applications received came to seventy-one (Table 3).

Thirty-six applicants formally accepted the invitation to participate in the program. Six applicants declined the invitation. A few Fellows delayed their response while waiting for other possible offers from other programs. The top researchers tend to apply to more than one program, and will make their selection based on research interest and stipend. Thirteen positions were budgeted by NASA Headquarters. Twenty-three positions were funded by the LaRC Competencies (Table 4).

The average age of the participants was once again 46.

Table 1 - Distribution of 2001 ASEE Fellows
by Year in Program



5 of 18 Returning were from previous program years 14%.

Table 2 - Distribution of 2001 ASEE Fellows
by University

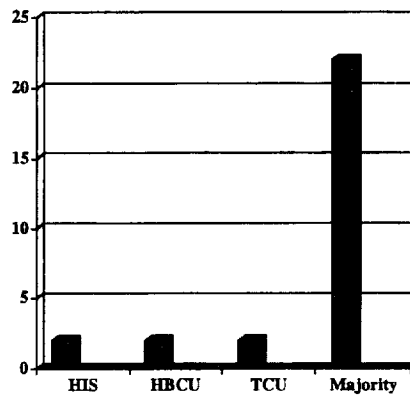


Table 3 - Distribution of 2001 ASEE Fellows
by Selection

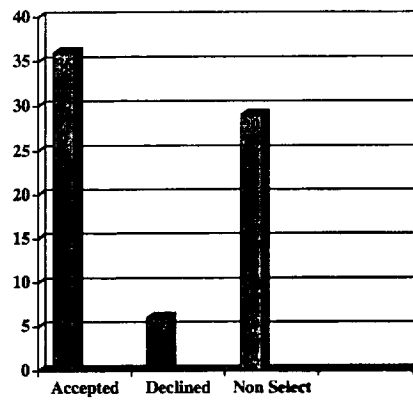
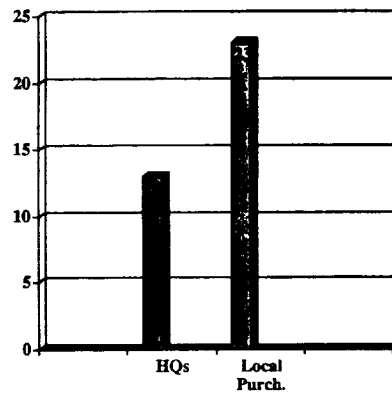


Table 4 - Distribution of 2001 ASEE Fellows
by Funding



SECTION III

STIPEND AND TRAVEL

A ten-week stipend of \$10,000.00 was awarded to each Fellow. Thirty-six percent of the Fellows indicated that the stipend was not the primary motivator in their participating in the ASEE program. This continues to suggest that the importance of the stipend amount is quite significant based on the fifty-five percent that indicated at least in part it was a primary motivator. Eight percent did not answer. One hundred percent of the faculty suggested an increase was in order (Survey-Section VI). This stipend continues to fall short of matching what most professors could have earned based on academic salaries or participating in other fellowships. The decision to participate in the summer faculty research program continues to reflect the willingness of the Fellow to make some financial sacrifice in order to have the experience of working with NASA's finest scientists and researchers.

Mileage or air fare expenses incurred by the Fellows from their institution to Hampton, Virginia, as well as their return trip, were reimbursed in accordance with current ODU regulations. A relocation allowance of \$1,000 was provided for the Fellows at a distance of 50 miles or more who were required to relocate.

SECTION IV

2001 ASEE SFFP ACTIVITIES

Lecture Series

The Lecture Series this summer was successful and well received. There were a total of four regular lectures presented, and two brown bag luncheon lectures. The lectures were given by distinguished NASA scientists and researchers. Some of the topics included "Mars: An Abode for Past or present Life," presented by LaRC's Dr. Joel S. Levine who is traditionally our kick-off lecturer for the summer, "Experiences and Challenges in Planetary Exploration, " presented by LaRC's Dr. Robert D. Braun, and "Emerging Materials Technologies for Aerospace Applications," joint presentation by Drs. Joycelyn S. Harrison and Mia Siochi (Appendix II). The brown bag luncheon lectures were presented by Mr. Dennis M. Bushnell, NASA Langley's Senior Scientist. The first lecture on "Future Strategic Issues/The Frontiers of the Responsibly Imaginable" was so well received, that he did an encore presentation entitled, "Future of Aerospace".

Interaction Opportunity/Picnic

The annual Office of Education Interaction Opportunity/Picnic was held on Wednesday, June 13, 2001, for the summer program participants, their families, NASA Associates, and invited guests.

This allowed for informal interaction between the Fellows, as well as, with the administrative staff. The participants also had the opportunity to purchase T-shirts bearing the 2001 ASEE design.

Proposal Seminar

A Proposal Seminar was held for the Fellows on Tuesday, July 10, 2001. Mr. Edwin J. Prior, Deputy Director, Office of Education, presented an overview of the proper procedures to adhere to in submitting an unsolicited proposal to NASA. The program covered both the NASA and university perspectives. Mr. Robert L. Yang and Mrs. Kelly Wright gave a presentation on the Small Business Innovative Research program with emphasis on STTR, "Small Business Technology Transfer Program." Dr. Thomas A. Gally, Prof. William L. Nichols, and Dr. Jerry H. Tucker, returning ASEE Fellows, shared their experiences with successfully obtaining a NASA funded grant. There was also a panel question and answer session. The panel members included Langley researcher, Dr. Emily "Mia" Siochi, who frequently reviews proposals that are submitted, and Ms. Marcia Poteat representing grants and contracting. Together with the program presenters already mentioned, they answered questions posed by the ASEE Fellows in attendance. This aspect of the proposal seminar was very well received. The Fellows received packages with information including the most current Research Grant Handbook information and web site locations.

Seminar/Banquet

On Friday, July 27, 2001, a seminar/banquet was held for the Fellows and their spouses. The banquet took place at the beautiful Langley Air Force Base Officer's Club. ASEE end of the program information, certificates, and group pictures were presented to each Fellow at the banquet. Remarks were presented by Dr. Samuel E. Massenberg, Director, Office of Education.

ASEE Activities Committee

As in the past, an ASEE Activities Committee was formed to plan social outings for the program participants and their families. The most popular events were the weekly dinners planned for those who desired to participate. This allowed for an excellent informal networking opportunity between Fellows and staff that attended. Tours of Center facilities including a wind tunnel, simulator, and Langley Air Force Base were scheduled. This was very well received by the Fellows. (Appendix II).

In addition, the Program Manager/Administrative Assistant annually hosts a Spouses Luncheon for the Fellows' spouses who are in the area for the first time. All spouses are invited and encouraged to attend. This allows an opportunity for meeting one another and planning social outings for the families of the Fellows.

SECTION V

RESEARCH PARTICIPATION

The ODU-LaRC Summer Research Program, as in past years, placed the greatest emphasis on research aspects of the program. Included in this report are abstracts from the Fellows showing their accomplishments during the summer. These abstracts, together with the comments of the LaRC Research Associates with whom the Fellows worked very closely, provide convincing evidence of the continued success of this part of the program. The Fellows' comments during the evaluation of the program indicated their satisfaction with their research projects, as well as, with the facilities available to them.

The research projects undertaken by the Fellows were greatly diversified as is reflected in their summer research assignments. Their assignments were as follows:

Number of Fellows Assigned	Competency/Program Office
8	Aerodynamics, Aerothermodynamics, and Acoustics Competency
5	Airborne Systems Competency
2	Atmospheric Sciences Competency
3	Business Management
12	Structures and Materials Competency
6	Systems Engineering Competency

Thirty-one (86%) of the participants were holders of the doctorate degree. Four (11%) held master's degrees and one (3%) held bachelor's degrees. The group was again highly diversified with respect to background. Following are the areas in which the last degree was earned (twenty-three different disciplines):

Number	Area of Degree
1	Architecture
2	Chemistry
2	Education
18	Engineering (including 2 Aerospace; 1 Chemical; 1 Computer and Electrical; and 5 Electrical; 1 Engineering Mechanics; 1 Mechanical and Aerospace; 7 Mechanical; 1 Polymer; 1 Structural)
1	Fine Arts and Theater
1	History

1	Marketing
3	Mathematics (including 1 applied & 1 theoretical and applied)
1	Pathology
4	Physics (including 1 applied)
1	Physiology
1	Structural Mechanics

Extensions

Per special written request by the LaRC Associate and the approval of the ASEE Co-Director, the following individuals were granted an extension of tenure:

Dr. Tarek Abdel-Fattah
Dr. William Edmonson
Dr. Rusty Greene
Dr. Kiran Kirande
Prof. William Nichols
Dr. Ronald Pollock
Prof. Mir Shirvani
Dr. Eduardo Socolovsky
Dr. George Tucker

Attendance at Short Courses, Seminars, and Conferences

During the course of the summer, Fellows have the opportunity to attend regularly scheduled Langley Research Center seminars and meetings, to include but not limited to ASEE Technical Lectures, Institute for Computer Applications in Science and Engineering (ICASE) seminars, World Wide Web and Internet training courses, computer training, as well as short courses or meetings within their Competency. In addition, there were a number of short courses, seminars, and conferences, in which the subject matter had relevance to the Fellows' research projects. A number of Fellows requested approval to attend one or more of these conferences as it was their considered opinion that the knowledge gained by their attendance would be of value to their research projects. Those Fellows who did attend had the approval of both the Research Associate and the University Co-Director.

Short Courses, Seminars, and Conferences Attended

Tarek Abdel-Fattah: "Biomimetic Flight" seminar with J.B. Anders, "Emerging Material Technologies for Aerospace Applications," seminar with Dr. Joycelyn Harrison and Dr. Emilie Siochi, and the Office of Education Proposal Seminar.

Effi Barry: Small Disadvantaged Business/University Opportunities Forum.

Tom Gally: AIAA 19th Applied Aerodynamics Conference, Virginia Tech Green Engineering Conference.

William L. Nichols: Viking 25th Anniversary Commemoration at LaRC, August 20, 2001, Multicultural Education Issues LAFB Guest Speaker, August 11-25 2001.

Ronald J. Pollock: Technology 2010 Conference, Varian Short Course on Gas Chromatography and Mass Spectroscopy

Ollie J. Rose: “Evaluating the Measurement Process,” short course with Donald Wheeler.

Carmina Sanchez-del-Valle: SDB/UO Forum 2001, Viking 25th Anniversary Forum at LaRC, “Computers that Build Themselves.”

M. Roman Serbyn: Small Disadvantaged Business/University Opportunities Forum June 20-21, 2001.

Eduardo A. Socolovsky: “Imaging Science 2001,” sponsored by SIAM, September 22-24, 2001.

Sang Sub Song: Small Disadvantaged Business/University Opportunities Forum, Small Opportunities for Small Business, Small Disadvantaged Business and Women-Owned Business, “Emerging Material Technologies for Aerospace Applications,” seminar.

Larry E. Tise: Society of Historians of the Early American Republic, July 20-22, 2001.

George F. Tucker: NASA Certification Course on Handling Moon Rock and Meteorite Samples.

Donald H. Voegelé: Viking 25th Anniversary Commemoration at LaRC.

Youqi Wang: Nano-Technology Seminars (3).

N. Eva Wu: American Control Conference, June 25-27, 2001, Materials Research Seminar, July 24, 2001, Luncheon Presentation by Dr. Bushnell, July 18, 2001.

Han Zhu: Technology 2010 Conference, August 1, 2001, FAA & NASA Composite Research Workshop, June 18-20, 2001, ANSYS Modeling of Multiphysics, August 3, 2001.

Papers Presented or Anticipated

***Indicates Anticipated Papers**

***Tarek Abdel-Fattah:** "Synthesis of Carbon Nanotubes," to be submitted to Science or Chemistry of Materials, and to NASA, Langley.

***Todd A. Anderson:** "Damage Detection in Electrically Conductive Membrane Structures," to be submitted to AIAA SDM Conference, "Damage Detection in Electrically Conductive Composites," NASA LaRC/SMC/MDB.

Tom Gally: AIAA 20th Applied Aerodynamics Conference, June 2002.

***Rustin Greene:** "NASA 'Why?'" Episode to be submitted to Broadcast Education Association's Faculty Juried Production Competition.

***Monson H. Hayes:** "Complex Decimation Filters in Fourier Transform Spectroscopy," and "N-bit encoding of (N+1)-bit Data".

***George R. Inger:** "Local Heating Across a Surface Catalytic Discontinuity Using Triple deck Theory," with P.G. Gnoffo to be submitted to Journal of Thermophysics and Heat Transfer.

***Feng Liu:** "Combustion in Accelerating Flows," NSF.

***Richard Louie:** "Development of Giant Magnetoresistance Inspection Systems for Detection of Deep Fatigue Cracks Under Airframe Fastener," presented at 2001 Review of Progress in Quantitative NDE.

***Eric Mockensturm:** "Vibration Analysis of Stretched Lens Array" to be submitted to AIAA SDM Conference, "Predicting Wrinkles in Gossamer Space Structure" and "High Performance Piezoelectric Actuators for Morphing Structures," to be submitted to NASA LaRC.

***Stuart Munson-McGee:** "Viscoelastic Properties of Blyimide/Clay Nanocomposites," to be submitted to NASA LaRC.

***Kara Peters:** Technical Paper to be submitted to NASA Langley in October 2001, Health Monitoring of Reusable Launch Vehicle Airframe Structures, NASA Marshall.

***Ronald J. Pollock:** "Continuous Oil Analysis & engine Wear," Aviation Safety Program Office.

***Carmina Sanchez-del-Valle:** "Structures of Materials from Space to Earth," and "Bio-inspired Structures: Architectural Possibilities," to be submitted to ACADIA, "Geometrical Modelling of Morphing Structures," to be submitted to ACADIA

***M. Roman Serbyn:** “Measurement of Background Noise in Piezoresistive and Electret Condenser Microphones” to be submitted to the 142nd meeting of Acoustical Society of America in December 2001, Ft. Lauderdale, FL.

***Eduardo Socolovsky:** “A New Clustering Algorithm and Flocking Visualization,” to be submitted to “Interface 2002”

***Larry E. Tise:** Various presentations at NC First Flight Symposium October 22-25, 2001 at N.C. State in Raleigh, NC.

***George F. Tucker:** Anticipate submitting a paper at a Symposium at the National Institute of Standards, *A History of Encasements Technology Preserving the Charters of Freedom*, September 17, 2001.

***Youqi Wang:** “Application of FEM in Nano-scale Analysis of Polymers,” to be submitted to 43rd AIAA/ASME/ASCE/AHS Structures, structural dynamics, and materials conference.

***Gregory M. Wilkins:** Proposal to be submitted to Applied Computational Electromagnetics Society, March 2002, IEEE Antennas and Propagation Symposium, June 2002.

***Keith Williamson:** “Laser Assisted Stir Welding Thick Plate Steels,” Welding Journal, May 2002.

***N. Eva Wu:** “Reliability Assessment Issues in Aviation Safety Program Reliability Evaluation of AFTI-16 Control System UNIPASS and it’s Role in Aviation Safety Program.”

Z. Charlie Zheng: “On Vortex Methods for Slat Noise Prediction,” AIAA Aeroacoustic Conference, June 2002.

***Han Zhu:** “Thermal/Mechanical Response and Damage Growth in Polymeric Composites at Cryogenic Temperature” by Karen S. Whitley, Han Zhu, and Tomas S. gates to AIAA, April 2002.

Anticipated Research Proposal Submission

Tarek Abdel-Fattah: “The Synthesis of Carbon Nanotubes,” NASA LaRC.

Todd A. Anderson: “Damage Detection in Electrically Conductive Composites,” NASA LaRC/SMC/MDB.

Effi Barry: Potential proposal to AOL, Time Warner, NSF, ARCO, Bell South, A&T, National Foundation for the improvement of Education, Carlisle Foundation Grants, Intel Foundation.

Brian P. Beecken: Potential proposal to NASA LaRC.

Rustin Greene: Potential proposal of programs for Office of Education at NASA, LaRC.

George R. Inger: Potential proposal to Aerothermodynamics Branch of NASA LaRC for continuation of research in collaborative agreement with Dr. P.G. Gnoffe.

Eric Mockensturm: “Predicting Wrinkles in Gossamer Space Structures,” NASA LaRC, “High Performance Piezoelectric Actuators for Morphing Structures,” NASA LaRC.

Stuart Munson-McGee: “Viscoelastic Properties of Blyimide/Clay Nanocomposites,” NASA LaRC

William Nichols: Potential proposal on developing ethnobotany components with research on suitability for space exploration with NASA LaRC.

Ronald J. Pollock: “Continuous Oil Analysis & Engine Safety,” “Nanotube Synthesis and Characterization.”

Ollie J. Rose: “Exploration of Advanced Research Methodologies in Computational Fluid Dynamics Analysis, Verification and Validation,” NASA LaRC, AAA/RFB.

Carmina Sanchez-del-Valle: “Technology Transfer: Materials for Earth-Bound Construction,” NASA LaRC.

M. Roman Serbyn: Continue work with planned submission of proposal to NASA LaRC.

Youqi Wang: “Modulus of Polymer Network and Nanotube Reinforced Polymer Network,” NASA LaRC

Gregory M. Wilkins: “Computational Numerical Electromagnetics for the Solution of Guided-wave and Radiating Systems,” NASA LaRC in response to NRA 01-OEOP-3 FAR.

Keith Williamson: “Laser Assisted Stir Welding Thick Plate Steels,” Virginia Advanced Shipbuilding and Carrier Integration Center

N. Eva Wu: “Reconfigurability and Fault Tolerant control of Aerospace Vehicles,” NASA LaRC

Z. Charlie Zheng: “A Revolutionary Airframe-Noise Modeling Based on Vortex Methods,” NASA LaRC

Han Zhu: “Damage and Permeability Study of PMC Composites in Distribution Cryogenic Temperature,” NASA LaRC.

Funded Research Proposals

Feng Liu: “Combustion in Accelerating Flows,” NSF

M. Roman Serbyn: Institutional Grant to Morgan State University from NASA HQ

Larry E. Tise: “Edition of Papers of Wilbur and Orville Wright,” NASA Education Office

Jerry H. Tucker: “Development of a Miniature Embedded Reconfigurable Computer and Logic Module” NASA LaRC.

Gregory M. Wilkins: “ The BESTEAMS Model of Team Development Across the Curriculum,” Natural Science Foundation CCLI-EMD, Department of Defense HPCMP/PET Program

SECTION VI

SUMMARY OF PROGRAM EVALUATION

A program evaluation questionnaire was given to each Fellow and to each Research Associate involved with the program. The questions and the results are given below and on the following pages from the thirty-six of thirty-six evaluations were returned (100%).

A. Program Objectives

1. Are you thoroughly familiar with the research objectives of the research (laboratory) division you worked with this summer?

Yes	<u>33</u>	(92%)
No	<u>3</u>	(8%)

2. Do you feel that you were engaged in research of importance to your Center and to NASA?

Yes	<u>36</u>	(100%)
No		
No Response	<u> </u>	(0%)

3. Is it probable that you will have a continuing research relationship with the research (laboratory) division that you worked with this summer?

Yes	<u>31</u>	(86%)
No	<u>0</u>	(0%)
Uncertain	<u>5</u>	(14%)

4. My research colleague and I have discussed follow-up work including preparation of a proposal to support future studies at my home institution, or at a NASA laboratory.

Yes	<u>24</u>	(67%)
No	<u>7</u>	(19%)
Uncertain	<u>5</u>	(14%)
N/A		

5. Are you interested in maintaining a continuing research relationship with the research (laboratory) division that you worked with this summer?

Very much so	<u>32</u>	(89%)
Somewhat	<u>4</u>	(11%)

B. Personal Professional Development

1. To what extent do you think your research interests and capabilities have been affected by this summer's experience? You may check more than one.

Reinvigorated	<u>21</u>	(58%)
Redirected	<u>15</u>	(42%)
Advanced	<u>27</u>	(75%)
Barely maintained	<u> </u>	
Unaffected	<u> </u>	

2. How strongly would you recommend this program to your faculty colleagues as a favorable means of advancing their personal professional development as researchers and teachers?

Positively	<u>36</u>	(100%)
Not at all		
No Reply		

3. How will this experience affect your teaching in ways that will be valuable to your students? You may check more than one.

By integrating new information into courses	<u>29</u>	(80%)
By starting new courses	<u>2</u>	(5%)
By sharing your research experience	<u>29</u>	(80%)
By revealing opportunities for future employment in government agencies	<u>21</u>	(58%)
By deepening your own grasp and enthusiasm	<u>19</u>	(53%)
Will affect my teaching little, if at all	<u> </u>	(0%)
No Response		

4. Do you have reason to believe that those in your institution who make decisions on promotion and tenure will give you credit for selection and participation in this highly competitive national program?

Yes	<u>26</u>	(72%)
No	<u>6</u>	(17%)
No Answer	<u>4</u>	(11%)

C. Administration

1. How did you learn about the Program? Check appropriate response.

Received announcement in the mail	<u>11</u>	(30%)
Read about in a professional publication	<u>3</u>	(8%)
Heard about it from a colleague	<u>12</u>	(33%)
Other (Explain below)	<u>10</u>	(28%)

Previous ASEE Fellow (4); LaRC NASA Web Site (2); Saw a posted announcement (1); Through a visit to NASA Langley (1); Recruited by LaRC OEd staff at conference (1); e-mail (1)

2. Did you also apply to other summer faculty programs?

Yes 12 (33%) No 24 (67%)

<u>1</u> DOE	Other <u>2</u>
<u>6</u> Another NASA Center	
<u> </u> Air Force	
<u>1</u> Army	
<u>6</u> Navy	

3. Did you receive an additional offer of appointment from one or more of the above? If so, please indicate from which.

Yes 6 (17%) No 19 (53%) No Answer 11 (30%)

4. Did you develop new areas of research interests as a result of your interaction with your Center and laboratory colleagues?

Many	<u>12</u>	(33%)	None	<u>1</u>	(3%)
A few	<u>23</u>	(64%)	No reply		

5. Would the amount of the stipend (\$1,000 per week) be a factor in your returning as an ASEE Fellow next summer?

Yes 24 (67%) No 12 (33%)

If not, why? Research outcomes are more important; Stipend level should be increased.

6. Did you receive any informal or formal instructions about submission of research proposals to continue your research at your home institution?

Yes	<u>28</u>	(78%)
No	<u>8</u>	(22%)
No reply	<u> </u>	(0%)

7. Was the housing and programmatic information supplied prior to the start of this summer's program adequate for your needs?

Yes	<u>35</u>	(97%)
No	<u>0</u>	(0%)
Somewhat	<u>0</u>	(0%)
Not Applicable	<u>1</u>	(3%)

8. Was the contact with your research colleague prior to the start of the program adequate?

Yes	<u>34</u>	(94%)
No	<u>2</u>	(6%)
Somewhat	<u>0</u>	(0%)
No Answer	<u>0</u>	(0%)

9. How do you rate the seminar program?

Excellent	<u>28</u>	(78%)
Good	<u>7</u>	(19%)
Fair	<u>1</u>	(3%)
Poor	<u> </u>	(0%)
No reply	<u> </u>	(0%)

10. In terms of the activities that were related to your research assignment, how would you describe them on the following scale?

	Adequate	Too Brief	Excessive	Ideal	N/A
Research	18 (50%)	7 (19%)	----	11 (30%)	----
Lectures	19 (53%)	2 (5%)	----	13 (36%)	2 (5%)
Tours	23 (64%)	----	----	11 (30%)	2 (5%)
Social/Recreational	24 (67%)	----	----	10 (28%)	2 (5%)
Meetings	21 (58%)	2 (5%)	----	9 (25%)	4 (11%)

11. What is your overall evaluation of the program?

Excellent	<u>33</u>	(92%)
Good	<u>3</u>	(8%)
Fair	<u>0</u>	(0%)
Poor	<u>0</u>	(0%)

12. If you can, please identify one or two significant steps to improve the program.

See Fellows' Comments and Recommendations

13. For second-year Fellows only. Please use this space for suggestions on improving the second year.

See Fellows' Comments and Recommendations

D. Stipend

1. To assist us in planning for appropriate stipends in the future, would you indicate your salary at your home institution?

\$ 58,578* per Academic year x or Full year ____.
 Median Range **Based on 34 professors' salaries provided.*

2. Is the amount of the stipend the primary motivator to your participation in the ASEE Summer Faculty Fellowship Program?

Yes 2 (5%) No 13 (36%) In Part 18 (50%) No Answer 3 (8%)

3. What, in your opinion, is an adequate stipend for the ten-week program during the summer of 2000?

~\$8K-1 (3%); \$10K-0; \$11-2 (5%); \$12K-7 (19%); \$12.5K-2 (5%); \$12K to \$15K-2 (5%); \$13.5K-1 (3%); \$14K-2 (5%); \$15K-11 (30%); \$15K to \$17K-1 (3%); \$15K to \$18K-1 (3%); \$15 to \$20K-1 (3%); \$18K-1 (3%); \$20K-2 (5%); Other-2 (8%) see below

(1) Willing to work for \$0 if funding for research supplies and release time made available
(2) Program should target assistant professors whose salaries are about \$60-\$70K for 9 months. ASEE stipend can be a little less than that, but not much less.

E. American Society for Engineering Education (ASEE) Membership Information

1. Are you currently a member of the American Society for Engineering Education?

Yes 9 (25%) No 26 (72%) N/A 1 (3%)

2. Would you like to receive information pertaining to membership in the ASEE?

Yes 20 (56%) No 11 (30%) Not Indicated 5 (14%)

Fellows' Comments and Recommendations

Both ASEE Fellows and NASA Associates were asked to provide comments and recommendations relative to their participation in an effort to provide continuous improvement in the quality of the ASEE Program. Below are the responses received to various questions. All responses from one faculty member are grouped under a single bullet.

- To improve the program, provide start up funds for continuing research that is promising after the end of the program.
- The amount of the stipend was not as much a factor because the experience is invaluable. I honestly can't really think of much to improve except instead of increasing the stipend, just reimburse housing expenses.
- Include educators as a part of the lecture series. It is a wonderful opportunity for me to share my experiences with future teachers, as well as further develop my own skills. Teachers need more hands-on experiences utilizing technology to better prepare them for the classroom. The PSTI provides just that.
- The relocation allowance must be larger. It must be stressed to the research colleague that they have to plan on investing time in and giving direction to the faculty member. It is very hard to walk into a functioning research group and contribute in only 10 weeks without guidance. Regarding the stipend being the primary motivator - I would not be here without the stipend, or a chance to do productive research, but the relocation is the very costly part. The proposal seminar was very helpful and inspiring. But, it would have helped a great deal to have a handout with a concise description of all the possible avenues for obtaining grants from NASA.
- I live very close to the facilities, so the extra financial burden is minimal...although the \$1,000/week is not commensurate with my salary. A greater stipend would improve the program.
- It is time to increase the stipend. There is a need for resources to support Fellows away from the site.
- The seminars are wonderful for engineers, but are of little value to molecular biologists. I suggest scheduling seminars in the evening. Make us more aware of operations at NASA, in particular the lag-time to order supplies and the budget year issues. I would be willing to work for nothing if I could get funding for research supplies and release time.
- Increase the stipend. Include Dennis Bushnell in the lecture schedule. Also, some lectures were introduced as repeats from the previous year; if so, perhaps attendance could be optional. This is an excellent program. The quality of work (creativity, passionate focus on excellence) on the Center, and the wonderful, generous people working here, make this an amazing and invigorating experience. Thank you.
- Frankly, I'm already well paid by my university. I enjoy the summer ASEE experience because of the work and people it brings me into contact with. There is no time for meetings in only a 10-week work period. There is a tendency to paint too rosy a picture about available funding for university research. My Associate was so busy we had insufficient time to interact and develop new ideas, etc.

Fellows' Comments and Recommendations cont.

- The stipend is much lower than normal typical faculty summer salaries in a research university, even for junior faculty. In addition, travel, living cost allowances are lower than actual cost. Provide more interactions with active NASA researchers and more information on research funding. The program should target assistant professors whose salary levels are about 60-70K/9 month. The ASEE stipend can be a little less than that, but not too much less.
- A detailed map of the Center (such as the "LaRC West Area Map") would be helpful so we don't waste time getting lost. Also, some details about the weather would help too, for faraway folks. Lecture attendance should be mandatory. There's very little opportunity to meet with ASEE Fellows who don't attend lectures, lunches, or tours. My next statement is not intended to reflect on my Associate who I feel has been excellent. From talking to other Fellows, I feel that some Associates take their ASEE Fellows for granted because Education is footing the bill. Some Associates seemed ill-prepared to best use the Fellow's time. I feel that the Associates should make more of an effort to write a proposal to "win" an ASEE Fellow. The present process seems rather chaotic (although it may not be). Debbie Murray has been exceptionally helpful in every aspect of life here. If the program stipend is not raised (or even if it is), make sure she gets a bonus. More advertising is in order, to get the word out about the ASEE program.
- Be sure the lectures vary from year-to-year.
- Although more money would help defray added costs incurred, I am here for the experience. Arrange for housing discounts if feasible, have a stronger weekly seminar program, closer ties to LARSS and other Office of Education projects. Facilitate more involvement in research project activities and meetings. Include some travel money so Fellow has the option of accompanying his/her Associate to off-Center meetings.
- Increase stipend and time. Provide more flexibility with time and weekends. Provide a small petty cash research fund. Great program, well run, and efficient. Most importantly, friendly.
- I would have liked to hear a few more lectures about NASA programs...two or three of the weekly lectures were cancelled.
- The seminar (proposal) needed more specific information. A template of a good proposal would be helpful. Please provide more detailed information on how to put a proposal together.
- More formal/intensive lecture series. One meeting where Fellows provide a brief description of their work, more informal than the Final Presentations.
- I am more interested in the research than the money; of course, the stipend is essential. It would be helpful to receive some support for continuing the work in one's home institution, where applicable. My suggestion relates to the preceding question: where feasible, try to have continuity. My summer was very productive and enjoyable. The ability to find satisfactory housing was an important factor, but there seemed to be a shortage of affordable and conveniently located rooms/apartments. The list provided to the faculty and students

Fellows' Comments and Recommendations cont.

should be expanded. An easy way to do this would be to ask those currently on the list to get the word out to their friends...my landlord has already done so.

- Increase stipend to at least the level of other ASEE Summer Faculty Programs. Move general lectures to afternoon and increase technical level beyond demonstration. Organize prior contact with Research Associates, to provide head start opportunities for the research (10 weeks is too short), as well as follow-up opportunities. The program provided excellent opportunities for research and collaboration. It opened the possibility of continuing the research through sabbatical leave. Head, Associate Head, and everybody down the line in the Branch (including contractors) were extraordinarily welcoming and cooperative. It was a pleasure to work in their environment. I haven't had this much fun doing research in many years!!
- Provide computer and telephone.
- Stipend needs to be higher. I was very happy to have this time to expand upon work begun last year.
- There should be a contact who makes sure that items such as computer access, after hours access, and card keys are in place before Fellows arrive.
- A wider scope of people to work with, Associates or Mentors, to facilitate making further progress on my project.
- Debbie Murray did an excellent job.
- I welcome the opportunity to work with the members of this research group. The program is run very effectively. I cannot think of any improvements, perhaps other than the withholding of taxes on the stipend. The second year was equally as good as last year. I have appreciated the opportunity. My only concern is the fact that taxes are not being withheld from our stipends, and it makes for a very difficult situation at tax time. The figure of \$13,500 as summer stipend is equivalent to the stipend for the NAVY-ASEE Summer Faculty Fellowship Program.
- Increase the stipend to attract more participation.
- Put ASEE participants' name, employer, year, NASA Branch, and NASA Associate over the web.

SUMMARY OF ASSOCIATES' EVALUATION

The following comments and recommendations were taken from the questionnaire distributed to the ASEE Associates requesting them to evaluate the overall performance of their ASEE Fellow. Most all of the Associates responding indicated an overwhelming satisfaction with the Fellow's knowledge of their subject, diligence, interest in assignment, and enthusiasm. A total of twenty-eight (78%) evaluations were returned. See statistics based on the number returned below:

- 96% were made aware of participation as Associate prior to start of program

- 96% contacted Fellow prior to start of program
- 93% stated Fellows accomplished established research goals with a high level of satisfaction
- 96% interested in serving as Associate again (one-no due to retirement)
- 79% indicated there was discussion of possible follow on research via submission of a proposal
- 88% with first year Fellows indicated a desire to continue research with the 2002 program
- 86% indicated their Fellow was above average when compared overall with other faculty researchers they had worked with before
- 82% indicated the programmatic support/operations of the Office of Education was outstanding/exceptional.

Research Associates' Comments and Recommendations

- I appreciate your efforts in bringing professors to LaRC under the ASEE Program, and in accommodating schedule and time constraints.
- Excellent Program.
- The Office of Education should publish some of the successes of the ASEE program. It is a pleasure to work with the Office of Education and Debbie Murray. The ASEE process is painless, and the program works flawlessly. Debbie is certainly a credit to the Office of Education and as asset to LaRC. Without a doubt, her efforts make the ASEE program the huge success it is. Thanks.
- I wondered if the presentation of work by ASEE participants is widely publicized. I'm not sure if I get the announcements only because I'm involved in the program. It seems that it would be an excellent, cross-center cut, sampling of the types of research that goes on here- and would benefit from a larger audience.
- No changes seem necessary at this time.
- Office space with net connection and phone pre-coordinated and covered before their arrival would be a recommendation.
- This experience was very positive. The only thing I could suggest would be more time in the initial planning process before the Fellows' arrival.
- I would not recommend any changes to the ASEE program. The services, products, and results speak highly of the program. The ASEE program offers the LaRC researcher the opportunity to acquire a skill/knowledge at a greatly reduced cost of doing the specialized work under contract.
- I appreciate the opportunity to get this kind of help with my research.
- The Associate-Mentor training meeting could be deleted for non-first time Associates, with any changes from previous years sent out in an e-mail.

SECTION VII

CO-DIRECTOR'S RECOMMENDATIONS

1. It is enthusiastically recommended that the program continue. It is a valuable and effective means of contributing to the research objectives of the NASA Langley Research Center, it enriches and refreshes the faculty and their home institutions, and it furthers the professional knowledge of the participating faculty and their students. These conclusions are supported by the assessment and evaluation instruments given to the faculty participants, and the NASA research associates.
2. The informal luncheons following the lectures were very successful. This occasion provided an excellent opportunity for the faculty participants to discuss the lecture topic and related concerns in depth with the guest lecturers, and also develop professional contacts that will aid and enhance their professional development.
3. The weekly evening dinners were very well attended. This allowed a more informal atmosphere for networking amongst the Fellows and the ASEE Administrative staff.
4. It is recommended that the RADIO (Research and Development Interaction Opportunities) activities be expanded and formally included in the national model of the NASA/ASEE program. Similar to the intent of JOVE, the faculty recipients would receive small awards to facilitate student presentations at professional meetings or development and distribution of curricular materials. This recommendation is offered in the spirit of the agency's interest in providing the broadest dissemination of NASA research results to the public. This activity is a cost-effective method of providing this E/PO service.

APPENDIX I

2001 NASA Langley ASEE Summer Faculty Fellowship Program Fellows

<u>Name and Institution</u>	<u>NASA Associate & Competency/Program Office</u>
Dr. Tarek M. Abdel-Fattah (R) Christopher Newport University	Dr. Emilie J. "Mia" Siochi Structures and Materials
Dr. Dr. Todd A. Anderson University of Washington	Dr. Damodar R. Ambur Structures and Materials
Prof. Effi S. Barry (P) Hampton University	Mr. Roger A. Hathaway Office of Education
Dr. Brian P. Beecken Bethel College	Dr. Martin G. Mlynczak Atmospheric Sciences
Dr. William W. Edmonson Hampton University	Dr. Qamar A. Shams Aerodyn., Aerothermodyn. & Acoustics
Dr. Thomas A. Gally (R) Embry-Riddle Aeronautical University	Mr. Richard L. Campbell Aerodyn., Aerothermodyn. & Acoustics
Dr. Mark S. Gray Christopher Newport University	Dr. Emilie S. "Mia" Siochi Structures and Materials
Dr. Rustin P. Greene (P) James Madison University	Mr. Robert M. Starr Office of Education
Dr. Monson H. Hayes (R) Georgia Institute of Technology	Dr. David G. Johnson Systems Engineering Competency
Dr. George R. Inger Iowa State University	Dr. Peter A. Gnoffo Aerodyn., Aerothermodyn. & Acoustics
Dr. Kiran W. Karande Old Dominion University	Dr. Kara A. Latorella Airborne Systems
Dr. Feng Liu University of California-Irvine	Dr. David M. Schuster Structures and Materials
Dr. Richard N. Louie Pacific Lutheran University	Mr. Russell A. "Buzz" Wincheski Structures and Materials

2001 NASA Langley ASEE Summer Faculty Fellowship Program Fellows Cont.

<u>Name and Institution</u>	<u>NASA Associate & Competency/Program Office</u>
Dr. Eric M. Mockensturm Pennsylvania State University	Mr. Richard S. Pappa Structures and Materials
Dr. Stuart H. Munson-McGee New Mexico State University	Dr. John W. Connell Structures and Materials
Dr. Duc T. Nguyen (R) Old Dominion University	Mr. Manohar D. Deshpande Airborne Systems
Prof. William L. Nichols (R) Blackfeet Community College	Dr. Arlene S. Levine Atmospheric Sciences
Prof. Kara Peters North Carolina State University	Dr. Robert S. Rogowski Structures and Materials
Dr. Ronald J. Pollock (R) Pennsylvania State University	Mr. Warren C. Kelliher Systems Engineering
Dr. Scott E. Rimbey University of South Florida	Dr. Aaron H. Auslender Aerodyn., Aerothermodyn. & Acoustics
Dr. Ollie J. Rose (P) Mt. Olive College	Dr. Michael J. Hensch Aerodyn., Aerothermodyn. & Acoustics
Dr. Carmina Sanchez-del-Valle Hampton University	Dr. Damodar R. Ambur Structures and Materials
Dr. M. Roman Serbyn (R) Morgan State University	Dr. Qamar A. Shams Aerodyn., Aerothermodyn. & Acoustics
Mr. Mir S. Shirvani (R) New River Community College	Mr. Robert L. Fox Systems Engineering
Dr. Eduardo A. Socolovsky Hampton University	Mr. Ronnie E. Gillian Systems Engineering
Dr. Sang Sub Song North Dakota State University	Mr. Kevin N. Barnes Airborne Systems

2001 NASA Langley ASEE Summer Faculty Fellowship Program Fellows Cont.

<u>Name and Institution</u>		<u>NASA Associate & Competency/Program Office</u>
Dr. Larry E. Tise	(R)	Dr. Samuel E. Massenberg
East Carolina University		Office of Education
Dr. George F. Tucker	(R)	Mr. Glen W. Sachse
The Sage Colleges		Systems Engineering
Dr. Jerry H. Tucker	(R)	Mr. Qamar A. Shams
Virginia Commonwealth University		Aerodyn., Aerothermodyn. & Acoustics
Mr. Donald H. Voegelé		Mr. J. Otis Riggins, Jr.
Crownpoint Institute of Technology		Systems Engineering
Dr. Youqi Wang		Dr. Jeffrey A. Hinkley
Kansas State University		Structures and Materials
Dr. Gregory M. Wilkins	(R)	Mr. Manohar D. Deshpande
Morgan State University		Airborne Systems
Dr. Keith M. Williamson	(R)	Mr. Robert A. Hafley
Old Dominion University		Structures and Materials
Dr. N. Eva Wu	(P)	Dr. Christina M. Belcastro
Binghamton University		Airborne Systems
Dr. Z. Charlie Zheng		Mr. Craig L. Streett
University of South Alabama		Aerodyn., Aerothermodyn. & Acoustics
Dr. Han Zhu		Dr. Thomas S. Gates
Arizona State University		Structures and Materials

R-Designates returnees from 2000 years

P-Designates prior participants from earlier

APPENDIX II
LECTURE SERIES
PRESENTATIONS BY RESEARCH FELLOWS
CALENDAR OF ACTIVITIES

2001 OFFICE OF EDUCATION SUMMER LECTURE SERIES

Location: H.J.E. Reid Conference Center, Bldg. 1222

14 Langley Boulevard

Time: 11:00 a.m. - 11:45 a.m. - Lecture

11:45 a.m. - 12:00 p. m. - Questions and Answer

<u>DATE</u>	<u>TOPIC</u>	<u>SPEAKER</u>
Tuesday, June 12	Mars: An Abode for Past or Present Life?	Dr. Joel S. Levine Atmospheric Sciences Competency Langley Research Center
Tuesday, June 19	Experiences & Challenges in Planetary Exploration	Dr. Robert D. Braun Intelligent Synthesis Environment Langley Research Center
Tuesday, June 26	Biomimetic Flight	Mr. J. B. (Ben) Anders Aerodynamics, Aerothermodynamics, and Acoustics Competency Langley Research Center
<i>**ASEE Only Brown Bag Lecture</i>		
<i>Wednesday, July 18</i>	<i>Future Strategic Issues/The Frontiers of</i>	<i>Mr. Dennis M. Bushnell</i>
<i>11:30-12:30</i>	<i>the Responsibly Imaginable</i>	<i>Senior Scientist</i>
<i>LaRC Cafeteria-Buy Lunch First</i>		<i>Langley Research Center</i>
Tuesday, July 24	Emerging Materials Technologies for Aerospace Applications	Dr. Joycelyn S. Harrison and Dr. Mia Siochi Structures and Materials Competency Langley Research Center
<i>**ASEE Only Brown Bag Lecture</i>		
<i>Friday, August 3</i>	<i>Future of Aerospace</i>	<i>Mr. Dennis M. Bushnell</i>
<i>11:30-12:30</i>		<i>Senior Scientist</i>
<i>LaRC Cafeteria-Buy Lunch First</i>		<i>Langley Research Center</i>

NASA Langley Research Center
ASEE Summer Faculty Fellowship Program
and
Langley Aerospace Research
Summer Scholars (LARSS) Program

Office of Education Summer Lecture Series



July 17, 2000
11:00 a.m.

Upcoming Lecture

Dr. Kathie Olsen
Chief Scientist, NASA Headquarters
July 24, 2001, 11 a.m. - 12 noon
H. J. E. Reid Conference Center

Announcements

LARSS Wind Tunnel Tour

Thursday, July 19, 2001, 11 a.m.
Building 1212

"Mastering the Art of Technical Presentations"

Tuesday, July 24 and Wednesday, July 25
Sign up after lecture today.

Dr. Joycelyn S. Harrison & Dr. Emilie (Mia) J. Siochi

**Asst. Branch Head & Materials Scientist
Advanced Materials and Processing Branch
Structures and Materials Competency**

Dr. Joycelyn Harrison is the Asst. Branch Head of the Advanced Materials and Processing Branch of the Structures and Materials Competency at NASA Langley Research Center. She received B.S. degrees in Chemistry and in Chemical Engineering from Spelman College and Georgia Institute of Technology in 1987. Subsequently she earned M.S. and Ph.D. degrees in chemical engineering from Georgia Institute of Technology in 1989 and 1993 respectively. She joined then Composites and Polymers Branch in 1994 after gaining experience as an NRC post-doctoral associate for one year. Her research in smart materials focuses on the development of high performance electroactive and electrostrictive polymers. She also manages the Materials research program within NASA's Aircraft Morphing Program.

Dr. Mia Siochi is a Materials Scientist in the Advanced Materials and Processing Branch, Structures and Materials Competency, at NASA Langley Research Center. She received a B.S. degree in Chemistry from the Ateneo de Manila University, Philippines. Subsequently she earned a M.S. in Chemistry and a Ph.D. in Materials Engineering Science from Virginia Tech in 1985 and 1989 respectively. After a one year post-doc stint at Virginia Polytechnic Institute and State University, she joined Lockheed Martin Engineering and Sciences Co. as a contractor, providing polymer characterization support for the Composites and Polymers Branch at NASA Langley Research Center. Soon after joining the civil service ranks in 1998, she got involved with Biomimetics/Nanotechnology research to develop biologically inspired, nanoscale materials.

Emerging Materials Technologies for Aerospace Applications

The challenge in materials development for aerospace applications has always been the need to find materials that are lightweight, which do not sacrifice the excellent properties such as high temperature stability, strength and stiffness required for structural components. In recent years, these requirements have been met with high temperature matrix resin composites that are carbon fiber reinforced. NASA is now embarking on the search for the next generation of revolutionary materials that will go beyond lightweight, high strength materials to those that will allow us to build intelligent systems. In the past five years, the Advanced Materials and Processing Branch has led efforts in the development of electroactive materials for smart sensors and actuators. It is now poised to extend the Smart Materials development effort into new territory based on biologically inspired processes. This talk will discuss accomplishments in the Smart Materials development program, and where it is headed, as well as plans for revolutionary materials development based on biomimetics and nanotechnology.

**2001 American Society for Engineering Education (ASEE) Summer
Faculty Fellowship Program Final Presentations and
Best Research Presentation Competition**

H.J.E. Reid Conference Center

Tuesday, August 7, 2001

8:00 a.m. – 1:45 p.m.

8:00 a.m.	Welcome and Introductions	Dr. Surendra N. Tiwari, ASEE Co-Director
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Aerodynamics, Aerothermodynamics, and Acoustics Competency

8:10 University	“Constrained Aerothermodynamic Design of Hypersonic Vehicles”	Dr. Thomas A. Gally Embry-Riddle Aeronautical
8:40	“Modeling for Airframe Noise Prediction Using Vortex Methods”	Dr. Z. Charlie Zheng University of South Alabama
9:10	Break	

Airborne Systems Competency

9:20	“Optimal Design of Electromagnetics Engineering Systems Using Genetic Algorithms”	Dr. Duc T. Nguyen Old Dominion University
9:50	“An User Evaluation of the ARNAV (Area NAVigation) Weather Information System”	Dr. Kiran W. Karande Old Dominion University
10:20	Break	

Systems Engineering Competency

10:30 Technology	“FTS – The Ultimate Signal Processing Playground”	Dr. Monson H. Hayes Georgia Institute of
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Structures and Materials Competency

11:00	“Nanomanipulation, Lithography, and Computer Models: Building and Modeling Carbon Nanotube Magnetic Tunnel Junctions”	Dr. Richard N. Louie Pacific Lutheran University
11:30	“Semi-crystalline Polyimide/Organo- silicate Nanocomposites”	Dr. Stuart H. Munson-McGee New Mexico State University
12:00 noon	“Polymer Networks: From Non- Continuum to Continuum Mechanics”	Dr. Youqi Wang Kansas State University

12:30 p.m.	Closing Comments and Instructions	Dr. Surendra N. Tiwari
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2001 ASEE/LARSS Calendar of Activities

Date	Function
Monday, June 4	ASEE/LARSS Orientation Program - 9 00 a.m. H J E Reid Conference Center, 14 Langley Boulevard ASEE Ice-Breaker - 5-7 p.m. - H J E Reid Conference Center
Tuesday, June 5	ASEE Individual Flight Suit Photos behind the Hangar, B 1244 - 9 30 a.m.
Friday, June 8	ASEE Spouses Luncheon - Golden Corral Restaurant - 1123 W Mercury Blvd - 11 30 a.m.
*Tuesday, June 12	Lecture-H J E Reid Conference Center - <i>LARSS Pay Date</i>
Wednesday, June 13	ASEE/LARSS Picnic-H J E Reid Conference Center - Picnic Grounds - 4.00 - 8.00 p.m.
Friday, June 15	ASEE NASA CAVE and Simulator Tour - Meet in lobby of B. 1268A Arrive 15 Minutes Early and bring badge
*Tuesday, June 19	Lecture-H J E Reid Conference Center - <i>ASEE Pay Date</i>
Wednesday/Thursday, June 20-21	Small Disadvantaged Business/University Opportunities Forum (Wed. 6 p.m. - Reception at HU Museum, Thurs Forum at H J E Reid Conference Center)
Wednesday, June 20	LARSS Langley Air Force Base Tour 1 30 - 3 00 p.m.
Friday, June 22	LARSS NASA CAVE and Simulator Tour - 9 50 a.m.
*Tuesday, June 26	Lecture-H J E Reid Conference Center - <i>LARSS Pay Date</i>
Wednesday, June 27	ASEE Langley Air Force Base Tour 2:00 - 3:45 p.m.-Meet in 1216T1 parking lot 1:30 p.m.
Thursday, June 28	LARSS Graduate School Seminar - 12 30 p.m. - LaRC Cafeteria, NACA Room
Friday, June 29	ASEE Model Shop Tour B 1238B - Meet in front of Building - 10-11 a.m.
Tuesday, July 3	ASEE Pay Date - Come by Debbie's Office between 8:30 and 9:30 a.m. LARSS Individual Flight Suit Photos behind the Hangar, B 1244 - 8 20 a.m. (ASEE make up photos)
Wednesday, July 4	Holiday - ASEE Fellows invited to cookout at Briarfield Park, Boxwood Shelter, 2:30 p.m. See Deb for details.
*Tuesday, July 10	ASEE Proposal Seminar-H.J.E. Reid Conference Center 10-12 noon (<i>LARSS Pay Date - GROUP PHOTOS</i>)
Friday, July 13	ASEE 7 X 10 Wind Tunnel Tour 1 00 - 1 45 p.m. - Meet in front of B 1212
Tuesday, July 17	<i>ASEE Pay Date</i>
Wednesday, July 18	ASEE Only Brown Bag Lunch Lecture - 11:30-12 noon - Mr. Dennis Bushnell, LaRC Senior Scientist Cafeteria - NACA Room Plan to have your lunch purchased and ready to be seated by 11:30 a.m.
Thursday, July 19	LARSS 7 X 10 Wind Tunnel Tour 11 00 a.m. - Meet in front of B 1212
Mon-Fri, July 23-27	ASEE EDCATS on-line evaluation must be completed during this week http://ehb2.gsfc.nasa.gov/edcats/centers/asee.html
*Tuesday, July 24	Lecture-H J E Reid Conference Center - <i>LARSS Pay Date</i>
Wednesday, July 25	LARSS Seminar - "Mastering the Art of Technical Presentations" H.J.E Reid Conference Center - Time TBD
Friday, July 27	ASEE/LARSS Banquet-LAFB O'Club - 6 - 9 00 p.m.
Tuesday, July 31	<i>ASEE Pay Date</i>
Friday, August 3	ASEE Only Brown Bag Lunch Lecture - 11:30-12 noon - Mr. Dennis Bushnell, LaRC Senior Scientist Cafeteria - NACA Room Plan to have your lunch purchased and ready to be seated by 11:30 a.m.
Tuesday, August 7	ASEE Final Presentations and Best Research Presentation Competition-H J E Reid Conference Center
Friday, August 10	Last Day of Program - <i>Final ASEE/LARSS Pay Date</i> - Process Out 2 - 4 p.m. - H J E Reid Conference Center - Hampton Room

*Lectures will be at 11 00 a.m. --Arrive early for paydates indicated **Activities Committees will plan other social functions

APPENDIX III - GROUP PICTURE OF ASEE FELLOWS



Those pictured in group photograph from left to right are:

Front Row Kneeling: Dr. Carmina Sanchez-del-Valle, Dr. Kiran W. Kirande, Dr. Stuart H. Munson-McGee, Dr. Mark S. Gray, Dr. Rustin P. Greene, Dr. Scott E. Rimbey

Second Row Standing: Dr. Surendra N. Tiwari (ASEE Co-Director), Dr. Doris J. Jones (Louis Stokes Fellow), Dr. Keith M. Williamson, Dr. Eduardo A. Socolovsky, Dr. Feng Liu, Dr. M. Roman Serbyn, Dr. Thomas A. Gally, Dr. Tarek M. Abdel-Fattah, Dr. George R. Inger, Dr. Ollie J. Rose, Dr. Richard N. Louie, Dr. Ronald J. Pollock, Mrs. Debbie Murray (ASEE Program Manager)

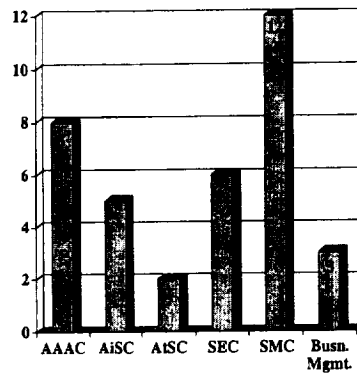
Third Row Standing On Stage: Dr. N. Eva Wu, Prof. Donald H. Voegelé, Dr. George F. Tucker,
Dr. Eric M. Mockensturm, Dr. Brian P. Beecken, Dr. Jerry H. Tucker, Prof. William L. Nichols, Prof. Kara Peters, Dr. Z. Charlie Zheng, Dr. William W. Edmonson, Dr. Youqi Wang, Dr. Gregory M. Wilkins, Dr. Han Zhu, Dr. Todd A. Anderson

Not Pictured: Prof. Effi S. Barry, Dr. Monson H. Hayes, Dr. Duc T. Nguyen, Prof. Mir S. Shirvani, Dr. Sang Sub Song, and Dr. Larry E. Tise

APPENDIX IV

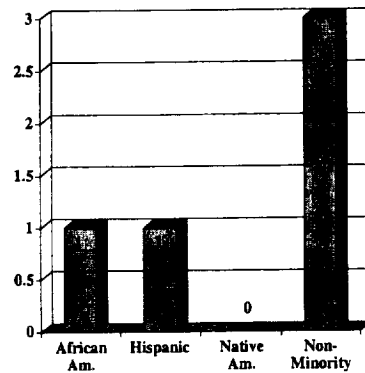
DISTRIBUTION OF FELLOWS BY UNIVERSITY RANK
and
DISTRIBUTION OF FELLOWS BY COMPETENCY/PROGRAM OFFICE

Distribution of 2001 ASEE Fellows by Competency/Program Office



Distribution of 2001 ASEE Female Fellows by Ethnicity

5 Female Fellows - 14% of all participants

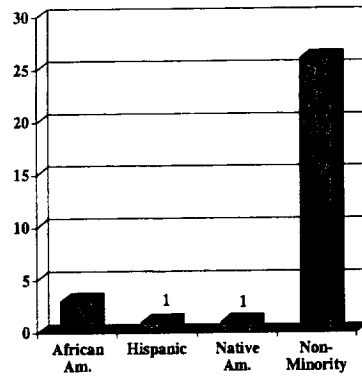


APPENDIX V

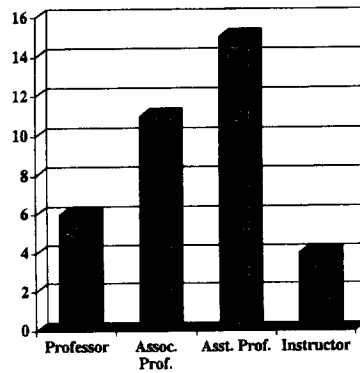
DISTRIBUTION OF FELLOWS BY ETHNICITY/FEMALE
and
DISTRIBUTION OF FELLOWS BY ETHNICITY/MALE

Distribution of 2001 ASEE Male Fellows by Ethnicity

31 Male Fellows - 86% of all participants



Distribution of 2001 ASEE Fellows by University Rank



APPENDIX VI

2001 ASEE SUMMER FACULTY FELLOWSHIP PROGRAM DISTRIBUTION OF FELLOWS BY UNIVERSITY PARTICIPATION

2001 ASEE SUMMER FACULTY FELLOWSHIP PROGRAM DISTRIBUTION OF FELLOWS BY UNIVERSITY PARTICIPATION

UNIVERSITY/COLLEGE	NO. OF FELLOWS
Arizona State University	1
Bethel College	1
Binghamton University	1
^Blackfeet Community College	1
Christopher Newport University	2
^Crownpoint Institute of Technology	1
East Carolina University	1
Embry-Riddle Aeronautical University	1
Georgia Institute of Technology	1
*Hampton University	4
Iowa State University	1
James Madison University	1
Kansas State University	1
*Morgan State University	2
Mt. Olive College	1
~New Mexico State University	1
New River Community College	1
North Carolina State University	1
North Dakota State University	1
Old Dominion University	3
Pacific Lutheran University	1
Pennsylvania State University	2
The Sage Colleges	1
~University of California-Irvine	1
University of South Alabama	1
University of South Florida	1
University of Washington	1
Virginia Commonwealth University	1

Total Number of Fellows	36
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Total Number of Institutions Represented	28
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*Indicates a **H**istorically **B**lack College or University (HBCU).

^Indicates a **T**ribal College or University (TCU).

~Indicates a **H**ispanic **S**erving Institution (HSI).

APPENDIX VII

ABSTRACTS - RESEARCH FELLOWS

Synthesis of Carbon Nanotubes Using Sol Gel Route

Tarek Abdel-Fattah, Ph.D.

Department of Biology, Chemistry, and Environmental Science

Christopher Newport University

Newport News, VA 23606

E-mail: fattah@cnu.edu

Since 1990, carbon nanotubes were discovered and they have been the object of intense scientific study ever since. A carbon nanotube is a honeycomb lattice rolled into a cylinder. The diameter of a carbon nanotube is of nanometer size and the length is in the range of micrometer. Many of the extraordinary properties attributed to nanotubes, such as tensile strength and thermal stability, have inspired predictions of microscopic robots, dent-resistant car bodies and earthquake-resistant buildings. The first products to use nanotubes were electrical. Some General Motors cars already include plastic parts to which nanotubes were added; such plastic can be electrified during painting so that the paint will stick more readily. Two nanotube-based lighting and display products are well on their way to market. In the long term, perhaps the most valuable applications will take further advantage of nanotubes' unique electronic properties. Carbon nanotubes can in principle play the same role as silicon does in electronic circuits, but at a molecular scale where silicon and other standard semiconductors cease to work.

There are several routes to synthesize carbon nanotubes; laser vaporization, carbon arc and vapor growth. We have applied a different route using sol gel chemistry to obtain carbon nanotubes. This work is patent-pending.

Damage Detection in Electrically Conductive Structures

Todd A. Anderson

Department of Aeronautics and Astronautics

University of Washington

Seattle, WA 98195-2400

E-mail: tanders@aa.washington.edu

High-technology systems are in need of structures that perform with increased functionality and a reduction in weight, while simultaneously maintaining a high level of performance and reliability. To accomplish this, structural elements must be designed more efficiently and with increased functionality, thereby creating multifunctional structures (MFS). Through the addition of carbon fibers, nanotubes, or particles, composite structures can be made electrically conductive while simultaneously increasing their strength and stiffness to weight ratios. Using the electrical properties of these structures for the purpose of damage detection and location for health and usage monitoring is of particular interest for aerospace structures. One such method for doing this is Electrical Impedance Tomography (EIT). With EIT, an electric current is applied through a pair of electrodes and the electric potential is recorded at other monitoring electrodes around the area of study. An inverse solution of the governing Maxwell equations is then required to determine the conductivities of discrete areas within the region of interest. However, this method is nearly ill-posed and computationally intensive as it focuses on imaging small changes in conductivity within the region of interest.

For locating damage in a medium with an otherwise homogeneous conductivity, an alternative approach is to search for parameters such as the damage location and size. Towards those ends, this study develops an Artificial Neural Network (ANN) to determine the state of an electrically conductive region based on applied reference current and electrical potentials at electrodes around the periphery of the region. A significant benefit of the ANN approach is that once trained, the solution of an inverse problem does not require costly computations of the inverse problem. This method also takes advantage of the pattern recognition abilities of neural networks and is a robust solution method in the presence of signal noise. The network is based on a two-tier approach where the coarse location of the damage is first located within given regions using a Learning Vector Quantization (LVQ) network. Once the approximate location is known, the second step is to apply a more refined feed-forward back-propagation (FFBP) ANN that utilizes the current and electric potential electrodes that focus on that region. In this manner, the resolution of the prediction scheme is increased. To train both the LVQ and FFBP networks, instead of time consuming and perhaps for large space structures, unfeasible experiments, a computational model is developed. The training function for the ANN is based on a finite element solution of the region and the applied boundary conditions. The inputs to the network are thus the location of the current electrodes and the corresponding electric potential values around the periphery and the network targets are the damage location and size. Future work will focus on the further development of the two-tier ANN, extension of the scheme for plural defects, and on the experimental validation of the computational training model for materials with isotropic and anisotropic conductivity.

ABSTRACT

Prepared by Effi Barry
ASEE Fellow
Office of Education

In Support of Pre-service Teacher Training

There has been a growing concern that a number of the nation's teachers are under qualified to teach our children, especially math and science. This concern has lead to many reforms in our educational systems. Good teachers are at the center of a successful education. Each child has a right to receive an excellent education from a highly qualified teacher. Education is the single most important way to allow millions of Americans to improve their status and quality in life, to increase their occupational opportunities, enhance their income, provide security, foster financial independence, and enable them to become good productive citizens.

The spotlight has also shone brightly on the quality of pre-service training and especially on the institutions that prepare them. If, in fact, we are determined to leave no child behind, it is vitally important to focus our energy and resources on the sound preparation of teachers. Teachers who enter the classrooms of our schools must be adequately prepared to provide our children with the knowledge and skills they will kind to survive and thrive in the highly technical 21st century.

Each and every child despite his or her race, ethnicity, or gender has the right to the best education this country can provide. In order for us to provide the best for our children, as a nation, we must assure that each pre-service teacher being educated to teach our children, has had the best opportunity not only to learn about technology, but also has mastered the skills needed to appropriately infuse its use in their daily teaching; especially in math and the sciences. The teachers' technology skills will adequately provide our children with the knowledge and skills they deserve, need, and will be required to possess, if they are to master the challenges and requirements for success in the highly technical 21st century.

In 1999, at an education conference, the Director of the National Science Foundation, Rita Colwell commented on the dilemma facing Minority -Serving Institutions. "It is critical that Minority-Serving Institutions be at the cutting edge of information technology. This is particularly important because minorities are under-represented in the information technology industry; an industry with wages that are 80% above the private sector average. What does it say about the future when the transformation in communications and computing-the cutting edge of science-has not yet swept major sectors of our population into the excitement?"

Preliminary Analysis of the Advantages and Limitations of a Stationary Imaging Fourier Transform Spectrometer

Brian P. Beecken, Ph.D.
Department of Physics
Bethel College
St. Paul, Minnesota 55112
E-mail: b-beecken@bethel.edu

Passive atmospheric remote sensing is an essential ingredient in climate studies, stratospheric chemistry, and tropospheric weather forecasting. Of crucial importance are observations of the unexplored far-infrared spectral region. Data in such regions are vital for understanding, modeling, and predicting future climate.

Currently, spectroscopic measurements of the atmosphere are done with one of two basic types of instruments: the diffraction grating spectrometer and the Michelson interferometer. The Michelson interferometer has two basic advantages. First, the Jacquinot advantage allows for a large energy throughput because it is possible to use a large aperture. The second, the Fellgett multiplex advantage, derives from the simultaneous processing of the entire spectral range during a single scan.

Unfortunately, the Michelson interferometer is a complex instrument, requiring moving parts and laser metrology for determining mirror positions. The result is a relatively massive instrument that requires a significant amount of power. These requirements diminish the utility of the Michelson for many applications. In particular, space-based systems have severe power and mass limitations. As a result, there is an effort at Langley Research Center to build and study a new type of stationary interferometer called SIFTS (Stationary Imaging Fourier Transform Spectrometer). This new type of sensor has no moving parts. It builds on the large format, two-dimensional detector arrays being produced by rapidly emerging detector technology.

The crucial question of this study is what effect the transition from a scanning interferometer to a stationary interferometer will have on the instrument's performance. Clearly, one important consideration is whether the traditional Jacquinot throughput and the Fellgett multiplex advantages of the interferometer will be maintained. The analysis is not yet complete. However, it is clear that although the stationary interferometer retains a throughput advantage it must be calculated differently. As for the multiplex advantage, it has been referred to by some authors as a disadvantage for stationary interferometers. Apparently, this advantage becomes a disadvantage when the detector array is of sufficiently high quality to be photon-noise-limited. Since the proposed detector arrays for SIFTS are detector-noise-limited, the multiplexing is unlikely to be a problem. Nevertheless, further work in this area would be prudent.

Digital Signal Processing System for Active Noise Reduction

William W. Edmonson, Ph.D.
Department of Electrical Engineering
Hampton University
Hampton, Va. 23668
E-mail: wedmonson@ieee.org

Over the years there has been a need to improve the comfort of passengers in flight. One avenue for increasing comfort is to reduce cabin noise that is attributed to the engine and the vibration of fuselage panels that radiate sound. High frequency noise can be abated using sound absorbing material. Though, for low frequency noise the sound absorption material would have to be very thick, thereby reducing the cabin size. To reduce these low frequency disturbances, active noise control systems (ANC) is being developed that utilizes feedback for cancellation of the disturbance.

The active noise control system must be small in size, be a low power device, and operate in real-time. It must also be numerically stable i.e. insensitive to temperature and pressure variations. The ANC system will be a module that consists of digital signal processor (DSP), analog-digital and digital-analog converters, power converters, an actuator and sensors. The DSP will implement the feedback control algorithm that controls the actuators. This module will be attached to panels on the inside of the fuselage for actively eliminating resonant modes of the structure caused by turbulent flow across the fuselage skin.

A hardware prototype of the ANC system must be able to eliminate broadband noise consisting of a bandwidth between 100 Hz and 1500 Hz, which requires a sample rate of 5000 Hz. The analog/digital converters output accuracy is 16 bits with a 2's-complement format and a very short acquisition time. This will also yield the appropriate dynamic range. Similar specifications are required of the digital/analog converter. The processor section of the system integrates a digital signal processor (TI TMS320C33) with analog/digital (Burr-Brown ADS8320) and digital/analog signal (DAC8531) converters. The converters with associated power conditioning circuitry and test points reside on a daughter board that sits on top of a Spectrum Digital evaluation module. This will have the ability to test different adaptive noise cancellation algorithms and provide an operational prototype to understand the behavior of the system under test. DSP software was required to interface the processor with the data converters using interrupt routines. The goal is to build a complete ANC system that can be placed on a flexible circuit with added memory circuitry that also contains the power supply, sensors and actuators.

This work on the digital signal processing system for active noise reduction was completed in collaboration with another ASEE Fellow, Dr. Jerry Tucker from Virginia Commonwealth University, Richmond, VA.

Constrained Aerothermodynamic Design of Hypersonic Vehicles

Tom Gally, Ph.D.
Aerospace Engineering
Embry-Riddle Aeronautical University
Prescott, AZ 86301
E-mail: gallyt@pr.erau.edu

An investigation has been conducted into incorporating a hypersonic capability into the CDISC (Constrained Direct Iterative Surface Curvature) aerodynamic design tool. In the first phase, a simple rule relating surface curvature (or rather d^2y/dx^2) to pressure coefficient gradients was formulated based upon Modified Newtonian Theory. The suitability of this rule is demonstrated by successfully driving surface shape modifications to match a target surface pressure distribution. While successful, it is noted that much of hypersonic design revolves around the leading edge and stagnation points - both of which are singularities in the design method. As a result, some concern still remains that there will exist particular design situations in which the method may fail or not lead to a desired result.

Next, a high level method for relating surface pressures to heat transfer rates was conceived and implemented as a design constraint. This method is based upon stagnation point theory and is suitable for design near vehicle leading edges where maximum heating rates typically occur. Validation of this method in 2-D was performed by successfully redesigning a surface shape to satisfy maximum surface heating constraints near a vehicle nose. Both these methods are currently being extended to 3-D geometries. Future work should investigate applying heating constraints on aft portions of the vehicle; simultaneously including additional constraints like lift, drag or pitching moment; and exploring additional constraints useful for applied vehicle design situations.

**Rapid Assembly of a High Molecular Weight Protein Polymer
Derived from a Cloned Oligopeptide Repeat Unit.**

Mark S. Gray

Department of Biology Chemistry and Environmental Science
Christopher Newport University,
Newport News, VA 23606
E-mail: mgray@cnu.edu

Synthesis of polymers of high molecular weight with absolute control of parameters such as size, composition, sequence topology, and stereochemistry, is not easily achieved with traditional methods of polymer synthesis. However, methods that utilize biosynthetic mechanisms, such as protein synthesis, hold great promise because of their natural ability to produce high molecular weight polypeptides with a high degree of sequence fidelity.

Two 40 base-pair (bp) DNA cassette sequences encoding for elastin-mimetic oligopeptides with different crosslinking capabilities were independently cloned using the seamless cloning procedure and the polymerase chain reaction (PCR). Both methods utilized the specific properties of a recently characterized restriction endonuclease *Eam*1104. Cleavage of the 40bp DNA cassettes with *Eam* 1104 generated nonpalandromic, complementary 5' cohesive ends that were ligated head to tail, then cloned or amplified via PCR to produce DNA concatamer libraries based upon the two cassette sequences. Each library was screened to identify clones or PCR products possessing DNA concatamers several thousand bp in length. These highly repetitive DNA sequences will be cloned into a bacterial expression vector so that each of the repetitive DNA sequences will be under the control of a strong promoter and behave as inducible synthetic genes. Cells containing either of the synthetic gene sequences will be able to produce relatively high quantities of a high fidelity, high molecular weight polymer possessing uniform and predictable characteristics not achieved via other means of synthesis. Using recombinant DNA technology

**Research and write an episode of *The NASA "Why?" Files* Television Series
"The Case Of The Wright Invention"**

**Rustin Greene, MFA
School of Media Arts and Design
James Madison University
Harrisonburg, Virginia 22807
greenerp@jmu.edu**

The NASA "Why?" Files is a standards-based, technology focused, distance learning initiative designed to integrate and enhance the teaching of math, science, and technology in grades 3-5. This series of instructional programs includes broadcast, print, and on-line elements. It emphasizes standards-based instruction, Problem-Based Learning, and science as inquiry, including the scientific method and science process skills, to introduce students in grades 3 - 5 to the excitement and exploration of real-world mathematics, science, and technology. *The NASA "Why?" Files* seeks to motivate students to become critical thinkers and active problem solvers. Each program supports the national mathematics, science, and technology standards and includes:

- A 60-minute video broadcast
- A companion educator's guide
- Web-based activities and materials
- Information about NASA programs, projects, facilities, and researchers

"The Case Of The Wright Invention" introduces students to the process of discovery and invention, and also celebrates the Wright Brothers' invention of the airplane. The program is divided into four parts, basically corresponding with the four parts of the invention process: Identify the problem, evaluate and select ideas, design and create a model, test and revise. I helped define the scope of the project and developed the program's content outline, conducted program content research and negotiated with potential participants, and wrote the script for the program. This episode will be produced this fall, and will be broadcast to over three million students on PBS in December, 2001.

Signal Processing Issues in Fourier Transform Spectrometers

Monson H. Hayes
School of Electrical and Computer Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0250

There are a number of interesting and challenging signal processing problems related to the design of a Fourier Transform Spectrometer (FTS). In this project, we look at a few of these problems in two different types of spectrometers – the Geostationary Imaging Fourier Transform Spectrometer (GIFTS), and a Far Infrared (FIR) FTS.

One of the signal processing challenges in GIFTS is the reduction of the massive data rate (2.4×10^9 bps) to an affordable telemetry rate of less than 60 Mbps. Since the GIFTS interferograms are heavily over-sampled, the first step is to decimate (down-sample) the interferograms with minimal distortion while keeping the signal processing algorithms simple enough to be implemented in the GIFTS hardware. Therefore, the first problem we looked at was the design of the decimation filters. Specifically, we performed a detailed analysis of two competing approaches that were being considered. The first, proposed by the Space Dynamics Lab (SDL), was to use a double sideband (real) band-pass filter. The second, proposed by Lincoln Laboratories (LL), was to use a single sideband (complex) band-pass filter. What the study showed was that a complex filter (LL approach) results in a savings of about 25% in the filtering requirements for the long-wave band, while in the mid-wave band the savings are approximately 50%. As a result, the decision was made to use a complex filter.

Once the decision to use a complex filter had been made, we looked at some of the consequences of this decision. The most significant of these was the discovery that, with a complex filter, it is possible to extend the long-wave IR band beyond the folding frequency of 1174 cm^{-1} and recover the SO_2 line at 1176.5 cm^{-1} . What this requires is the design of a band-pass decimation filter with a wider pass-band, and consequently of higher order. Specifically, it was shown that with about 25% more filter operations, the elusive SO_2 line, believed to be irretrievable, could in fact be recovered.

While working on the decimation filtering requirements, an issue arose with respect to how the 16-bit long-wave interferogram data should be processed by a 15-bit USES chip. There were two approaches being considered, and each one had at least one serious drawback. Therefore, given the nature of the data that is to be processed by the USES chip, we developed an efficient loss-less encoder that is robust to errors, and is easily decoded. Since the encoder eliminates the drawbacks of the other two approaches, and greatly simplifies the signal processing requirements, the downlink board is currently being redesigned to include this encoder.

The last problem that was looked at involved an investigation into the optimum sampling strategy in the design of a far infrared FTS. The problem was to minimize the amount of spectral noise that is induced by non-uniform mirror velocity.

Local Heating Across a Surface Catalytic Discontinuity Using Triple-Deck Theory

Prof. George Inger, Ph.D.
AEEM Dept.
Iowa State Univ.
Ames, IA 50011
inger@iastate.edu

Surface property discontinuities on a hypersonic vehicle are most often associated with the junction of two different thermal protection materials. They may also be associated with abrupt loss or deposition of surface coatings or changes in thermal conductivity and heat capacity of sensors on a test article. The abrupt jump in surface properties(catalytic efficiency, emissivity) in the presence of dissociated flow in hypersonic flight will lead to rapid changes in the local heat transfer rate.

While the induced heating associated with discontinuous surface properties can be very large, the length scale of the interaction is usually poorly resolved by conventional CFD grids. A purely numerical analysis of the problem can be addressed by a local grid refinement in the flow direction until the interaction is fully resolved. However, a better approach-one that provides physical insight and reduces the computer time required for design-is to couple a local, analytic solution of the interaction region around the discontinuity with a CFD solution obtained on a conventional grid.

The present research is developing an analytical, triple-deck theory of the local viscous-inviscid interaction field generated by a catalytic surface jump on a flat body such as the windside of a Reusable Launch Vehicle. The theory will be validated in detail by direct comparisons with a finely-resolved Navier-Stokes numerical code. Treatment of the rapid heat transfer changes both upstream and downstream of the jump is included. In this way, we expect to both clarify the interactive physics and provide a useful tool for preliminary design studies involving this problem.

An User Evaluation of the ARNAV Weather Information System

Dr. Kiran Karande
Old Dominion University

Weather is a factor in approximately 30% of aviation accidents. Weather is also responsible for approximately two-thirds of air carrier delays- a four billion dollar cost, of which 1.7 billion dollars are considered avoidable. The goal of NASA's AWIN (Aviation Weather Information Network) program is to provide improved weather information to users in the National Airspace System, and to foster the improved usage of this information (<http://awin.larc.nasa.gov>).

One of the avenues pursued by AWIN is to improve the availability of weather information in cockpits of general aviation aircrafts. NASA funded a project by ARNAV Systems Inc. for the development of a system that provides graphical and text weather information in the cockpit of general aviation aircraft. Our study investigates how ARNAV weather system users evaluate their weather information system. The dimensions used for evaluation are based upon discussions with researchers at NASA Langley Research Center and the human factors literature, and include usability criteria such as efficiency, satisfaction, memorability, and errors, as well as design criteria such as the display size, location, symbols, functionality, information content and quality. In-depth interviews were carried out with seven pilots from the Virginia Department of Aviation in Richmond. Results helped identify design improvements that would enhance the usability of the weather information system. Findings of this study are important because they will lead to improved system design and also offer directions for future research.

Faster and More Accurate Numerical Methods for Flutter and Nonlinear Aeroelasticity

Feng Liu, Associate Professor
Department of Mechanical and Aerospace Engineering
University of California, Irvine
Irvine, CA 92697-3975
Telephone/fax: 949-824-1750
E-mail: fliu@uci.edu

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Abstract

Computational Fluid Dynamics (CFD) has proven to be a useful tool for the simulation and prediction of buffet, flutter, and Limit Cycle Oscillation (LCO) phenomena of aero-elastic systems. Methods ranging from the linear double-lattice method to methods that solve the full Navier-Stokes equations have been developed. The CAPTSD-V is a NASA computer code that is the most widely known and used. The CAPTSD code has many advantages over other codes. However, experiences have shown the need for increased robustness and enhanced accuracy in the presence of flow separation for CAPTSD-V or any method of the Interactive Boundary Layer (IBL) type in order to make them dependable tools. The goal of this research has been to explore methods that will improve the CAPTSD-V code and in general to develop faster and more accurate numerical methods for flutter and nonlinear aeroelastic phenomena. The author has studied the CAPTSD-V code and examined carefully the integrated boundary layer method under the guidance of LaRC researchers. Strategies have been proposed to improve the CAPTSD-V code for better efficiency, accuracy, and robustness. New methods are also proposed for following up collaborative research between the faculty fellow NASA Langley Research Center. We will start by developing an accurate and robust Interactive Boundary Layer (IBL) method building on the existing strength of CAPTSD-V. This includes the addition of the time-dependent term in the integral boundary layer method and improved coupling method for interaction between the potential flow and the boundary layer solutions. We then propose the development of an Euler method based on small perturbation boundary conditions and new novel methods for coupling Euler and boundary layer solutions. Finally, other advanced methods based on the Euler and the Navier-Stokes equations are proposed for potential future topics.

Nanomanipulation and Lithography: The Building (and Modeling) of Carbon Nanotube Magnetic Tunnel Junctions

Richard Nam Louie, Ph.D.
Department of Physics
Pacific Lutheran University
Tacoma, WA 98447-0003
E-mail: louiern@plu.edu

Aircraft fuselages suffer alternating stress during takeoffs and landings, and fatigue cracks begin to grow, usually at rivet holes. The detection of these fatigue cracks under installed fasteners in aging aircraft is a major goal of the nondestructive evaluation (NDE) community. The use of giant magnetoresistance (GMR) sensors in electromagnetic (EM) NDE has been increasing rapidly. For example, here at Langley Research Center, a Rotating Probe System (RPS) containing a GMR element has been incorporated into a product to detect deeply buried flaws in aerospace structures.

In order to advance this eddy current probe application and many similar ones, research to create smaller, more sensitive and energy-efficient EM sensors has been aggressively pursued. Recent theoretical and experimental work on spin coherent transport supports the feasibility of carbon nanotube (CNT) based magnetic tunnel junctions.

In this study, a spatial filtering scheme is presented that improves the signal to noise ratio of the RPS and does not significantly impact the number of false alarms. Signals due to buried flaws occur at higher frequencies than do signals due to rivet tilt or probe misalignment, and the strategy purposefully targets this fact. Furthermore, the spatial filtering scheme exploits decreases in the probe output that are observed immediately preceding and following the peak in output due to a fatigue crack. Using the new filters, an enhanced probability of flaw detection is expected.

In the future, even tinier, more sensitive, low-power sensors are envisioned for the rotating probe and other nondestructive inspection systems. These may be comprised of single-walled carbon nanotubes (SWCNTs) that connect two ferromagnetic (FM) electrodes. Theoretical work has been done at Langley to model the electrical and magnetoconductance behavior of such junctions, for systems containing short "armchair" nanotubes. The present work facilitates the modeling of more realistic system sizes, through the re-writing of a critical code segment that gives a hundredfold improvement in speed. Furthermore, the tight-binding model calculations are now generalized to include *all* types of nanotubes, not merely armchair tubes.

On the experimental side, innovative junction fabrication procedures are investigated, including diamond-tip scanning probe lithography and e-beam lithography. Programs are written for the Nanometer Pattern Generation System to effect the creation of many junctions at once, to increase the chances of a CNT connecting two FM electrodes. As it is not prudent to rely solely on luck, the capability for tube nanomanipulation with an unprecedented level of control is also shown, and a procedure for controlled deposition upon chemically functionalized lithographic patterns is discussed. All of the techniques demonstrated can be used to create a magnetic tunnel junction to be refrigerated for extensive magnetoconductance studies.

STATIC AND DYNAMIC ANALYSIS OF STRETCHED MEMBRANE LENSES FOR LIGHTWEIGHT SPACE SOLAR ARRAYS

Eric M. Mockensturm
Department of Mechanical and Nuclear Engineering
Pennsylvania State University
University Park, Pennsylvania 16803
email: emm10@psu.edu

NASA and ENTECH, Inc. have been developing space photovoltaic arrays using refractive concentrator technology since 1986. These refractive concentrators use Fresnel lenses in a unique arch shape to minimize the effects of shape errors. In 1994, silicone Fresnel lenses were used in the SCARLET[®] solar array developed by ENTECH and AEC-ABLE. In this array the 200-micron-thick lenses were laminated to 75-micron-thick, thermally shaped, ceria-doped glass arches. These glass arches forced the flexible lenses into the optimal arch shape. The arrays constructed using these lenses achieved over 200 W/m² areal power and 45 W/kg specific power and are currently powering both the spacecraft and the ion engine on the NASA/JPL Deep Space One probe.

To further reduce weight and increase areal and specific power, the next generation of solar concentrator arrays will eliminate the glass arch and lens frame. The flexible lenses will be stretched as membranes between optimally shaped, supporting end arches. This patented stretched lens array will also use redesigned composite radiator sheets to reduce the weight of the SCARLET panels by a factor of four. In addition, by eliminating optical losses caused by the glass arches and lens frames, the SLA performance is higher than SCARLET. The SLA is the first solar array panel of any kind to simultaneously achieve over 300 W/m² areal power and 300 W/kg specific power.

While the optical properties of the stretched lenses are excellent, they must be analyzed structurally to ensure that they perform at their optimal levels. Lens parameters such as backing thickness, lens tension, and effective length can be altered to change the structural response of the lens without affecting the optical performance. In particular, the lenses must be designed to maintain the arch shape specified by the end support along the entire length. Because the lenses are flat in their natural state, they resist being bent into the desired arched shape and noticeable flattening can occur away from the end supports. While the optical shape intolerance designed into the lenses prevents this flattening from greatly affecting performance, flattening does reduce efficiency and should be minimized.

In addition to characterizing the static shape of the stretched lenses, it is also important to prevent dynamic deformations of the lenses which can also degrade optical performance. Thus, it is important to understand the dynamic response of these lenses so they can be designed to minimize vibration.

In this study, flat plate theory is used to characterize the static flattening of the lenses. Analytical solutions are obtained to determine the effect of backing thickness, strain, and effective length on the shape of the lenses away from the supports. Cylindrical shell theory is then used to determine the natural frequencies and mode shapes of the lenses in various configurations.

Characterization of Semi-crystalline Polyimide/Organosilicate Nanocomposites

Stuart H. Munson-McGee, Ph.D.
Department of Chemical Engineering
New Mexico State University
Las Cruces, NM 88003
E-mail: stumcgee@nmsu.edu

As part of a program to develop materials with enhanced mechanical and barrier properties for potential use in the fabrication of cryogenic fuel tanks and solar sails, nanocomposites prepared from a semi-crystalline polyimide (LaRC™ CPI) and organosilicates were investigated. The organosilicates evaluated in this work were montmorillonite clay treated with various organic salts to aid in its exfoliation in the polyimide. The polymer was prepared in the presence of the organosilicate for form an initial poly(amide acid)/organosilicate hybrid solution which was subsequently used to cast thin films that were imidized thermally in flowing air. The cured films were characterized for the effect of clay loading on the thermal and mechanical properties and completeness of exfoliation in the polymer matrix. In general, the films appeared transparent; however, incomplete exfoliation was apparent as determined by X-ray diffraction spectra. Increases in tensile modulus were obtained along with decrease in strength and elongation. The mechanical and thermal properties and clay exfoliation of these materials will be discussed.

**Optimal Design of Electromagnetics Engineering
Systems Using Genetic Algorithms**

Duc T. Nguyen

Old Dominion University
Civil & Environmental Engineering Department
135 KAUF Building
Norfolk, VA 23529

Email: dnguyen@cee.odu.edu

In this work, various strategies used in the genetic algorithms (GA) are discussed. Computer implementation of the developed FORTRAN code, and its application for optimum design of electromagnetics systems are emphasized.

The second objective for this work is to parallelize the developed “sequential” GA code, using Message Passing Interface (MPI) for numerical intensive electromagnetics research problems.

GIFTS-IOMI: Education & Public Outreach

William Nichols, MS Ed
Math-Science-Computers Division
Blackfeet Community College
Browning, MT 59417
e-mail: uanet107@montana.edu

GIFTS is an innovative blend of technologies that will provide continuous observation of the Earth's air and surface from geosynchronous orbit. It uses several innovative technologies to gather data on atmospheric temperature, distribution of trace gases, water vapor, clouds, and other items. The heart of GIFTS is a Fourier Transform Spectrometer that converts infrared images into accurate measurements of water vapor distribution and transport. The data will yield better weather forecasts. GIFTS will be launched in the Fall of 2004. It will occupy an orbital slot above the Western Hemisphere for the first twelve months of its mission. During that time, its technologies will be thoroughly tested. Its final orbit will be over the Indian Ocean where it can monitor developing weather patterns for NOAA and the U.S. Navy.

The scientists and technicians who are working with the GIFTS project want people to know about the science and technology that will make GIFTS work. NASA and the GIFTS project staff are very interested in public education, and helping everyone understand what remote sensing and space exploration are all about. This project and the EPO pages that were generated during it are the results of their enthusiastic interests in educating people about NASA's missions.

The purpose of this study is to research and screen all of the key technologies that will be resident on the GIFTS system for their suitability as features in the Education and Public Outreach component of the project. The goal of this study is to enlighten the world public about the technologies and monitoring capabilities of the GIFTS remote sensing satellite package. Specific objectives include: a) research the key technologies of the Sensor Module and the Control Module, b) simplify the terminology and descriptions to promote layperson understanding of the targeted technologies, c) coordinate references and links to supplement the descriptions, d) create low-tech curriculum units and lessons that illustrate the technologies, e) develop a series of web pages to post the descriptions and curriculum units along with supporting graphics and links, and f) pilot an evaluation component that can be linked to all of the EPO web pages from LaRC, SDL, and SSEC. Specific activities include reading the technical manuals, interviewing the key technology developers, conducting web searches to look for supporting links, creating a flexible web page format, coordinating with the LaRC Atmospheric Sciences –SDL – SSEC EPO personnel, among others. The initial outcome of this project is to identify three key technologies and develop web-based EPO units around them. The result of the project will be nine technology pages, an EPO home page, and a functional evaluation page. There are plans to host a workshop for educators to pilot the EPO pages and activities later this fall.

The units are user friendly so the lessons and activities can be experienced by anyone. Each unit presents a series of lessons with each lesson keyed to primary, middle school, secondary, or undergraduate education levels. The appropriate NCTM and the NSES standards regarding computation and inquiry serve as the background for all of the lessons and activities. The pages are set up to provide the public with information, links to activities, other web-sites, curriculum units, and lessons that will facilitate an understanding of NASA, GIFTS, and remote sensing satellite technologies.

Development of Interpretation Algorithm for Optical Fiber Bragg Grating Sensors for Composite Structures

Kara Peters, Ph.D.

Department of Mechanical and Aerospace Engineering

North Carolina State University

Campus Box 7910

Raleigh, NC 27695

E-mail: kjpeters@eos.ncsu.edu

Increasingly, optical fiber sensors, and in particular Bragg grating sensors, are being used in aerospace structures due to their immunity to electrical noise and the ability to multiplex hundreds of sensors into a single optical fiber. This significantly reduces the cost per sensor as the number of fiber connections and demodulation systems required is also reduced. The primary objective of this project is to study the effects of mounting issues such as adhesion, surface roughness, and high strain gradients on the interpretation of the measured strain. This is performed through comparison with electrical strain gage benchmark data. The long-term goal is to integrate such optical fiber Bragg grating sensors into a structural integrity monitoring system for the 2nd Generation Reusable Launch Vehicle.

Previously, researchers at NASA Langley instrumented a composite wingbox with both optical fiber Bragg grating sensors and electrical strain gages during laboratory load-to-failure testing. A considerable amount of data was collected during these tests. For this project, data from two of the sensing optical fibers (each containing 800 Bragg grating sensors) were analyzed in detail.

The first fiber studied was mounted in a straight line on the upper surface of the wingbox far from any structural irregularities. The results from these sensors showed a relatively large amount of noise compared to the electrical strain gages, but measured the same averaged strain curve. It was shown that the noise could be varied through the choice of input parameters in the data interpretation algorithm. Based upon the assumption that the strain remains constant along the gage length (a valid assumption for this fiber as confirmed by the measured grating spectra) this noise was significantly reduced.

The second fiber was mounted on the lower surface of the wingbox in a pattern that circled surface cutouts and ran close to sites of impact damage, induced before the loading tests. As compared to the first fiber, data from these gages indicated highly non-uniform strain along the gage length. This is to be expected in such regions. In contrast to the electrical strain gage, however, which averages out the effects of local strain variations, the Bragg grating can be used to measure the strain distribution through analysis of its reflected spectrum. However, such changes in the reflected spectrum, if large enough, can cause difficulties in the interpretation algorithm used. Several cases were studied in detail for gratings located near the cutouts. Further, the effects of structural vibrations were also seen to influence the measured strain.

Future work will be to incorporate one of several algorithms studied to invert the spectral response into the precise strain distribution along the gage into the grating analysis program.

On-Line Real-Time X-Ray Fluorescence Oil-Monitoring

Dr. Ronald J. Pollock, Ph.D.
Assistant Professor of Chemistry
Pennsylvania State University
Sharon PA 16146
(724) 342-1480
rip4@psu.edu

X-ray fluorescence, XRF, can determine the presence and quantity of all metals except lithium and beryllium under normal conditions. XRF equipment is continuously being reduced in size and is becoming available in smaller units. The miniaturization and feasibility of this method to continuously test for oil condition, contamination, and engine wear is the purpose of the ASEE 2001 Summer Project.

XRF testing is particularly promising because it not only monitors the lubricant, but more importantly it can determine the wear of equipment. The specific location of engine wear can be ascertained by correlating the XRF-identified metals with the composition of engine parts. This will save unnecessary costly repairs and valuable downtime. Testing time is in seconds, and the response to problems is rapid. Early detection can prevent major system failure and costly accidents. Continuous monitoring establishes engine history, trends, and personality of the engine. This is an ideal means for providing additional Black Box information for in-flight recordings. Developing miniaturized XRF equipment also can be used in NASA's space mission for exploration in our solar system.

There are several problems that must be resolved before XRF monitoring can be used for military and commercial aeronautics. These are the problems investigated in the ASEE 2001 Summer Program. Presently, a radioactive source is used to produce X-rays. This poses problems with regulatory licensing, with public sentiment, with safety, and with accidents. An effective long-life, miniaturized, non-radioactive x-ray source must be developed. Computer analysis of detected metals and other contaminants in the lubricant must be correlated with a catalog of parts and materials present in the engine. This is needed before interpreting the information and suggesting a correction.

The x-ray source, the detector, the energy dispersive multi-channel analyzer, and the software for collecting data and interpreting results must be optimized as a complete unit. The capabilities of this combination are not fully developed, and were the subject of our investigation this summer. This unit can possibly be used to determine the particles present by the scattering of x-rays. This can be accomplished because the shorter wavelengths of x-rays are scattered more than the longer wavelengths of laser light, producing a means for determining the number and size of particles in the lubricant.

The placement of the XRF monitor and proper in-line sampling design is important to optimize the monitoring. XRF monitoring is versatile, gives insight to the engine itself, has a greater range of analysis than is presently available, and is a promising means for guaranteeing safer and less costly air travel.

Shock Trains in Constant Area Ducts

Scott E. Rimbey, Ph.D.
Department of Mathematics
University of South Florida
Tampa, FL 33620
E-mail: rimbey@math.usf.edu

Back-pressuring supersonic internal duct flows leads to the development of shock trains within the duct. The length of the shock train increases with both the incoming Mach number of the flow and the ratio of the back pressure to the incoming pressure. For a given incoming Mach number, the upper limit on the ratio is generally slightly less than the normal shock pressure ratio. Achieving this upper limit typically requires a duct whose length is many times its height. Shorter ducts will only achieve some fraction of the maximum possible.

The development of a shock train is problematic in ramjet engines, where the back pressure is due to combustion and shock trains of sufficient length can unstart the inlet. To prevent unstart, an isolator is inserted into the engine flowpath between the inlet and the combustor to protect the inlet from the combustion-induced shock train effect. Since the inclusion of such an isolator undesirably increases the weight of the engine, it is important to quantify the length of the shock train as a function of the incoming Mach number and the pressure ratio. This was the purpose of this study.

The first phase of the study was to acquire a database of shock train cases for two different Mach numbers, 1.8 and 2.2. This database was generated using the CFD code VULCAN, written by Jeff White of NASA Langley. Several different pressure ratios were run at each Mach number; all cases used a rectangular grid with a length-to-height ratio of 20. The goal was to determine the highest allowable back pressure at which the shock train could be contained within the duct. The second phase of the study was to analyze the CFD database using one-dimensional conservation equations that include distortion. This analysis is ongoing, but it appears to be a promising technique for predicting the features of the shock train that most significantly affect the performance of a ramjet engine. Such predictive capabilities would provide a useful enhancement to engine performance cycle codes.

CFD Verification and Validation: Survey of Technology and Practice

Ollie J. Rose, Ph.D.
Mount Olive College

ASEE/NASA Fellow: Summer 2001

Abstract of Final Presentation

Results of an intensive literature survey in Verification and Validation of Computational Fluid Dynamics are discussed. Background concepts, including recommended distinctions between verification, validation, calibration and reconciliation are presented. Selected examples of Software Quality Engineering and N-version testing of computational solutions are presented and interpreted. The need for CFD V & V is emphasized by the results from these examples. An in-depth assessment of current technology and practice is given. A review of current V & V research areas and emerging technology is discussed. A research framework for exploiting existing and emerging technology is suggested.

Geometrical Concepts for the Active Shape Control of a Jet Inlet

Carmina Sanchez-del-Valle, D. Arch. R.A.
Department of Architecture
Hampton University
Hampton, VA 23668
E-mail: carmina.sanchez@hamptonu.edu

Preliminary research has demonstrated that the active shape control of conventional jet engine inlets can render aerodynamic performance benefits, in particular drag reduction. This is an initial study focusing on identifying form transformation or morphing concepts that would allow the leading edge of a nacelle to change shape from cruise to off-cruise position and vice versa, while maintaining its structural stability. A literature search was conducted in the areas of deployable structures, bio-inspired structures, robotics, shape memory alloys and elastomer polymers in an effort to find actuation mechanisms and solutions to similar geometric problems. Further study will involve the evaluation of promising morphing concepts through detailed modeling and testing. The selection of viable alternatives will be conditioned by a number of variables including recovery speed, life cycle, and weight/mass.

The leading edge portion of a nacelle is a hollow toroidal 3D continuous surface shell. Geometrically, the interior space defined by the shell approximates a catenoid bounded by two circles with different radii. The required transformation of the leading edge is effected through changing its interior and exterior cross-sectional diameter, and the shape of its longitudinal section. This must be a controlled gradual change. The dynamic reduction of the diameter or circumference of a toroid-shaped structure results in surface deformations that diminish its structural stability, and affect its aerodynamic performance (i.e. turbulence). In this case, such deformations are detrimental to the potential benefits made possible through shape morphing. Therefore, form transformation concepts must aim towards producing minimal, or no surface deformation.

The active shape control approach frames the solution to the shape morphing problem in the context of a controlled structure that contains sensors and/or actuators that are highly integrated into the structure and have structural and control functionality. (Wada and Fanson, 1990) Initially, concepts identified included a transformable support structure with a highly elastic skin. Examples of these were structural ribs with ratchet joints, structural frame with variable length struts, tension structures with SMA actuators, pressure membrane structures, and flexible honeycomb structures.

In the absence of a skin material that can morph without wrinkling or folding, it was decided to investigate alternatives for a segmented structural shell with active seams. Options dealt conceptually with the mechanics, materials, and structure of the seams created by dividing the leading edge into twelve segments. Concepts for mechanisms to open and close the seams involved worm gears, deformable pneumatic actuators, SMA actuators, piezoelectric actuators, elastomer actuators, tensegrity devices, scissor-hinged devices, and wrapping membrane devices.

Measurement of the Background Noise in Piezoresistive and Electret Condenser Microphones

M. Roman Serbyn
Department of Physics and Engineering Physics
Morgan State University
Baltimore, MD 21251
E-mail: rserbyn@morgan.edu

A typical microphone calibration must include tests of its sensitivity, frequency response, harmonic distortion, and background noise. While measurements of the first three parameters have become almost routine, the measurement of background noise requires special instrumentation and facility, and is more difficult to perform. Nonetheless, background-noise information is critical for all research and field applications of microphones relevant to the NASA mission. Responding to this demand, A.J. Zuckerwar of the Langley Research Center developed an acoustic isolation vessel for measurement of the background noise in microphones. [K.C.T. Ngo and A.J. Zuckerwar, J. Acoust. Soc. Am. **93**, 2974-2980 (1993)] As a summer faculty fellow, M.R. Serbyn has participated in the upgrading of that facility by improving its sound and vibration isolation and extending the frequency range of the measurements (1-100 kHz). The improved system, which is unique to the Langley Research Center, has been fully tested and interfaced with a PC for further processing of collected data. The background noise of several microphone types has already been measured, with more data to be collected on piezoresistive, electret-condenser, and piezoelectric microphones. These results will be helpful in constructing theoretical models for the prediction of background noise in the various microphones and in comparing their 1/f noise characteristics. Of particular interest are microphones to be employed in the so-called MEMS systems. When completed, the results of this study will help guide planners and test designers in the selection of microphones for applications requiring a large number of them.

Driver Module for Noise Cancellation System

Mir S. Shirvani
Department of Electronics Technology
New River Community College
Dublin, Virginia 24084
E-Mail: NRSHIRM@nr.cc.va.us

The Driver module is an integral part of the noise cancellation system, which was my primary objective to research, design, and prototype during the tenure in NASA Langley research center. The function of the driver module is to actuate a panel that is constructed with a smart material and invented in NASA-LaRC. The bandwidth and amplitude of the actuation of the panel correlates the undesirable structural bandwidth and amplitude of the applied object. The undesirable structural bandwidth is relatively narrow and the undesirable amplitude is relatively large.

After examining all the options the driver module was designed and prototyped. A highly stable, low distortion, linear monolithic integrated circuit was used as a variable frequency and amplitude function generator. In order to elevate the amplitude of the output waveform of the generator to a sufficient magnitude a pair of high voltage monolithic MOSFET operational amplifiers were implemented. The amplifiers connected in a bipolar bridge configuration for a higher efficiency. In order to reduce the required external supply voltages and make the driver capable to be operated by a battery a pair of ultra miniature high-output voltage dc to dc converters are also used. The driver module tested with the noise cancellation panel, the required data was acquired, and the result was promising.

Clustering in the Discovery and Simulation of Emergent Patterns in Data

Eduardo A. Socolovsky
Department of Mathematics
Hampton University
Hampton, VA 23668

E-mail: e.a.socolovsky@larc.nasa.gov , eduardo.socolovsky@hamptonu.edu

We developed a new more effective computational algorithm for the Clustering of Data in Vector Form based a parametric Pearson product-moment correlation measure of similarity. This type of clustering is necessary for the detection and tracking of data features, as used in Information Flocking and Multi-Agent Referral Systems for Matchmaking [1- 4]. This work is part of the research project on Swarming, a multi-agent computational paradigm for the discovery, design and simulation of emergent patterns in data.

Clustering is a widely used statistical analysis tool, which in the context of this project will be one of the underlying algorithms for feature and pattern extraction in wind tunnel and CFD data sets. The algorithm designed to overcome the $O(N^2)$ inner products required to obtain a similarity measure matrix [1-3], and also improve on the performance of *ad-hoc* Forward-Backward algorithms [4] . The algorithm is based on a quasi-metric property of projections, Householder transformations and geometrical properties.

Simulation and Visualization of Shielding Strategies for Human Space Exploration

In a continuing project to simulate the effect of radiation exposure and shielding on astronauts, the astronaut model will be constructed using the NIH Visible Human Project CAT, MRI and Photo data. In this initial phase, the raw image data sets were downloaded and data structures, segmentation masks, etc, were investigated. The software used for reconstruction of tissue and organs of the cadavers was surveyed and the VTK system was acquired and installed with a Tcl/VK wrapper. A least square fit to identify the parameters of the function that maps CT pixel values to tissue density was prepared.

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Adhesion and Lamination Testing of Langley Research Center-Soluble Imide (LaRC-SI) Polyimide Films

Sang Sub Song
Department of Mechanical Engineering
North Dakota State University
Fargo, ND 58105
Telephone: 701-231-8302
Email: sang_song@ndsu.nodak.edu

This study was investigated the development, evaluation, design and fabrication of the methodology of self-adhesion by melt-bonding multilayers of Langley Research Center-Soluble Imide (LaRC-SI) polyimide films that are employed in the fabrication of multi-layer flexible circuits. Previous efforts at Langley Research Center have had successful bonding results, however there has been little time and effort to perform an adhesiveless-melt-bonding multiple layers of film into one homogeneous material. The understanding of the structure, property, and processing relationships on self-adhesion of LaRC-SI polyimide films is important to their proper design and methodology.

The experiment was performed with the use of three commercial polyimide films, two types of LaRC-SI films, and with an addition of film to copper bonding test. The fully imidized LaRC-SI polyimide films was joined together in a self-adhesion lamination process to form a structure that is flexible and has superior mechanical and thermal properties. The lamination processing variables was investigated depending upon parameters such as autoclave temperature, pressure, soak time and final ply thickness. Control conditions included initial film thickness, sole-source manufacture, and lot number, and the percentage offset used to manufacture the LaRC-SI film. The evaluation of the structure film bonding was investigated in LaRC laboratories using scanning electron microscopy and photomicrography for morphology study, followed by mechanical and peel tests that are defined by ASTM standards. The thermal characterizations were performed using differential scanning calorimetry, and thermal gravity analyzer. In addition, the electrical parameter measurements were performed including dielectric constant, dissipation factor, strength, and resistivity.

RESEARCHING AND EDITING THE PRIVATE PAPERS OF WILBUR AND ORVILLE WRIGHT, 1900-1912

Larry E. Tise, Ph. D.

Wilbur and Orville Wright Visiting Distinguished Professor of History

East Carolina University

Greenville, N.C. 27858-4353

e-mail: ltise@attglobal.net

[permanent address: PO Box 17582, Philadelphia, PA 19103; phone 215.765.2418; fax 215.765.2721]

As we approach the first centennial of flight--that is, the anniversary of "the first manned, powered, controlled, and sustained flight of a heavier-than-air aircraft" by the brothers Wilbur and Orville Wright in 1903--there is a growing and renewed interest in telling the story of the Wright Brother; and in recalling it accurately, authoritatively, and interestingly. A review of the literature on the Wright Brothers a year ago indicated that there was a growing and abundant literature on the Wrights and their great achievements, including a number of new biographies and related works.

However, as a result of an examination of the manuscript and photo collections of the Wright Brothers at the Library of Congress and other collections in the North Carolina State Archives and the Outer Banks History Center in Manteo, North Carolina, it became clear that a majority of the original sources wherein Wilbur and Orville Wright--and their sister Katharine and father Milton--chart their progress with experimental aircraft--kites, gliders, and powered flyers--have never been edited and published.

The thrust of the summer 2001 project has been to identify, photocopy, catalogue, and document all unpublished Wright documents for the period 1900 until 1912 and the untimely death of Wilbur Wright. A further aim of the project has been the further transcription of these documents for publication in an edition of the "Private Papers of Wilbur and Orville Wright." One principal finding of this period of research is that 75-80% of all original documents after 1903 have never been published. These documents particularly reveal the strong bonds of the Wright family, their secret business activities, their disagreements over business pursuits, the glories and disasters of 1908 when they became world famous, but Orville crashed and nearly lost his life, and their agonizing loss of control and leadership in the world of flight.

This research activity is part of a larger goal to publish a definitive set of documents on the Wright experiences at Kitty Hawk in North Carolina between 1900 and 1911, to publish a definitive edition of the private papers of the Wrights, and to enhance activities leading to the commemoration of the centennial of flight in 2003 in North Carolina and around the world.

Determination Of the Composition of the Atmospheres in the Enclosures Containing the Charters of Freedom

George F. Tucker, Ph.D.
Department of Physics and Astronomy
Science Division
The Sage Colleges
Albany, NY 12208
E-mail: tuckeg@sage.edu

In the early 1950s, the United States Constitution, the Bill of Rights, and the Declaration of Independence, collectively known as the “Charters of Freedom,” were encased in specially designed enclosures. As a protective measure the enclosures were filled with moist helium and sealed. Currently a project is underway to remove the Charters from these encasements and re-encase them in modern enclosures. Before these cases are opened, conservationists at the National Archives and Records Administration (NARA) wish to know if air has leaked into the cases and what the relative humidity is. In 1998 NARA contacted NASA to request assistance with this problem. By adapting the NASA Diode Laser Hygrometer (DLH), an airborne sensor based on the absorption of infrared radiation at 1.4 microns by water vapor, the cases containing the second and third pages of the Constitution were non-invasively analyzed in 1999. Approximate relative humidity values were obtained. In addition, because the width of the absorption line is dependent on the other gases present it was possible to determine that the seals had not leaked. During the summer of 2001, the remaining documents were removed from public display and were made available for analysis.

To increase the sensitivity of the DLH to the presence of air, for the 2001 measurements a stronger water vapor absorption line was chosen, however this required locating a laser that operated at the wavelength of this stronger line. In this work a number of diode lasers were characterized and a suitable one was identified and installed in the DLH. A series of laboratory measurements of the chosen absorption line were performed to determine spectroscopic parameters including line strength, and helium broadening, air broadening, and self-broadening coefficients. The DLH was then reconfigured from its normal aircraft configuration to one more suitable for the Charters measurements. This involved installing it in a different housing, one specifically designed in 1998 for the Charters investigation, and installing all its associated electronics in a portable rack. From July 23 to July 26, 2001, measurements were performed at the National Archives II in College Park, Maryland. The data are still being analyzed, but preliminary results indicate that the seals on the remaining documents are intact and the relative humidity values are in the expected range. Further analysis is expected to result in more accurate relative humidity values and will also establish an upper bound on the amount of air contamination in the enclosures.

Feedback Control for Noise Reduction Program

**Jerry H. Tucker, Ph.D.
Virginia Commonwealth University
School of Engineering
Electrical Engineering Department
Richmond, VA 23284
e-mail: jhtucker@vcu.edu**

As part of Langley Research Center's continuing noise reduction program, an active noise control system (ANC) is being developed to suppress noise inside an aircraft cabin. This interior noise reduction system consists of the following major components: 1. Several accelerometers. 2. An input amplifier. 3. A digital signal processor (DSP) system that includes an analog to digital converter (ADC) and a digital to analog converter (DAC). 4. A high voltage power amplifier. 5. PZT actuators. 6. Power supply and distribution. The accelerometers detect interior panel vibrations. The accelerometer signals are fed to the input amplifier where they are conditioned prior to being sent to the ADC. The DSP receives the digitized signals from the ADC, processes these signals, and sends the result to the DAC. The DAC's analog output is used as input to the high voltage power amplifier. The power amplifier drives the PZT actuators to cancel noise from 50 to 1,300 Hz.

The specific area of concern for this work was development of a DSP system that could be used for an actual flight demonstration. It was decided to base the system on a commercially available DSP board, the Spectrum Digital eZdsp. This was complicated by the fact that the ADC and DAC capabilities available on the eZdsp board were not sufficient to meet the system specification. Designing and fabricating a special ADC and DAC daughter card for the eZdsp circumvented this problem. The DSP system hardware has been successfully tested and is currently being integrated into the complete noise reduction system.

This work has been completed in collaboration with another ASEE Fellow, Dr. William Edmonson from Hampton University and was conducted under the direction of the principle investigator, Dr. Qamar A. Shams of the Instrumentation Systems Development Branch, as part of a continuing noise reduction program.

EEE Parts Www Database Project/ Research, Summer 2001

Donald H Voegele, M.A.
Applied Computers Dept.
Crownpoint Institute of Technology
PO Box 849, Crownpoint, NM 87313
E-mail: don_Voegele@yahoo.com
Telephone, home: 505 786 5683

Ultimate goal of project: For EEE Parts to have a dynamic **Web site Database FORM** where various groups of users may display, insert, update, and delete data or **Query** according to that group's needs. An EEE Parts dynamic World Wide Web Site interacts with a database FORM to provide each **EEE Parts group** with an up-to-date record for each part. Each group (example: Design) updates their own data fields for their particular records and FORM. Parts groups are NASA wide and beyond. Previously a comprehensive LaRC NASA EEE Parts on-line Database did not exist. This project is a start in that direction. Strengths: The advantage of such a database FORM is its ease of use to access to information on all EEE parts.

Software being used: **Web Development Tool:** Microsoft Visual Interdev 6, provides a vast array of capabilities for creating powerful Web applications. **Database:** Microsoft SQL Server; a high-end client/ server database. **Web Site Creation and Management, HTML Editor:** Microsoft Front Page, tools to create, control and grow your Web Site. **Operating System:** Windows 2000: a Microsoft product and that has the best integration with Ms Visual InterDev, Ms SQL Server, and Ms Front Page. Windows 2000 includes a robust security system.

This **project** remains to be **continued**, "completed," and **constantly updated**. It is unfinished in the following areas: Linking and access control for each group's Form to the Web Site and server, and Data or field content entry for each EEE part or record. It is "on-track" in User Groups, Fields and FORMS for each User Group to access, and a Web Page. Each FORM (containing the fields), with one record for each part is for each User Group to use for monitoring and updating parts data. Such an up-to-date, Web accessed, parts database will be very useful to the EEE parts group, and associated NASA wide (and beyond) functions and projects.

For me the most valuable aspects of this ASEE summer project/ research are:

- 1) The **research project** itself, the opportunity to work with this database-driven Web site with its new **challenges/ ideas** and **software** variety, and the working for and with a highly experienced LaRC NASA associate.
 - 2) The LaRC NASA work environment of engineers, scientists, technicians, and support staff, a collaborative effort for research. The ASEE lectures and tours were wonderful.
 - 3) The context of LaRC: Hampton Roads/ Tidewater, Virginia, is a beautiful, lush, green, coastal multicultural, historic area with restaurants, shopping and tourist opportunities.
- Overall I feel very comfortable at LaRC. I am a Vietnam era USAF veteran and the LaRC environment, people and resources, reminds me of the best of my Air Force experience.

This has been the most beneficial (much learned), enjoyable and unique summer of my teaching career! People at LaRC and in Virginia have generally been so helpful and personable. I am honored to participate in the ASEE LaRC NASA summer faculty fellow program.

NASA-ASEE Summer Faculty Fellowship Program

Modulus of Polymer Network and Carbon Nano-Tube Reinforced Polymer Network (From non-continuum mechanics to continuum mechanics)

Youqi Wang
Department of Mechanical and Nuclear Engineering
Kansas State University
Manhattan, KS 66506
E-mail: Wang@MNE.ksu.edu

The goal of the research is to use a nano-scale finite element approach to predict the modulus of polymers and of nano-tube reinforced polymers. The research includes four parts:

1. Generate a polymer network using the Monte Carlo method. Polymer chains are created through the addition of monomers onto existing chains. Firstly, N monomers are distributed randomly within the material domain. More monomers are then randomly added onto the ends of these polymers under the restriction that chain length must be within a certain range. Interactions between monomers and polymer chains are analyzed as the polymer network is relaxed using a force relaxation process. Consequently, an equilibrium atomic field is generated within the polymer network.
2. Use of the nano-scale finite element approach to determine the modulus of the polymer network. As shown in Fig.1, the polymer chain is modeled by a chemical bond element chain, which is connected by elastic joints. The chemical bond element supports axial load like a spring element and supports bending moments like a beam element with infinite rigidity. The van der Waal attraction between polymer chains are modeled by a spring element with piecewise linear stiffness.
3. Generate a carbon nano-tube reinforced polymer field. This is divided into three steps. Firstly, a carbon nano-tube and N monomers are embedded in the material domain. Then, the N polymer chains grow from the N monomers using the Monte Carlo method. Finally, the polymer field is relaxed.
4. Calculating the modulus of the carbon nano-tube reinforced polymer network.

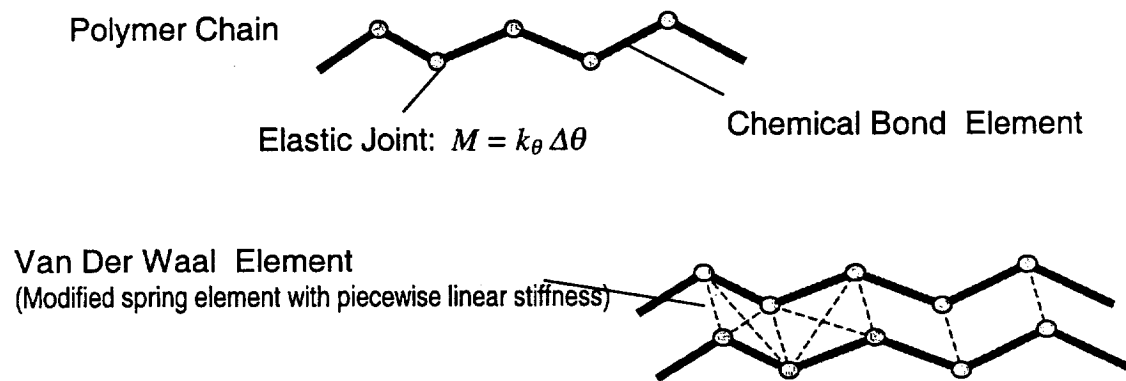


Fig.1 Nano-scale finite element analysis of polymer network

Computational Numerical Electromagnetics for the Solution of Guided-Wave and Radiating Problems

Gregory M. Wilkins, Ph.D.
Department of Electrical and Computer Engineering
Morgan State University
Baltimore, Maryland 21251
gwilkins@eng.morgan.edu

Electronic packaging encompasses several different scientific and engineering disciplines. These range from applied physics, which may address the stress analysis of the materials within the package, to thermal engineering, which probes the heat transfer between individual components. In the current research we are interested in the electrical aspects since our concern is to focus attention on the design of the components and the corresponding electromagnetic field behavior within the component, and to investigate the factors which may limit the performance of very-large-scale-integrated (VLSI) circuits. Much work is being done in the area of electromagnetic modeling, particularly in the higher frequencies of operation such as those involved in the use of microwave and millimeter wave integrated circuits (MIC, MMIC, respectively) for electromagnetic systems. Although we need to observe the electromagnetic effects on the individual circuit elements themselves, we must also take into account the effects due to materials and other parameters which support and connect these elements to one another. It is of great importance that we do not neglect the interconnections, and their environments, and that we incorporate this type of information into our design procedure. Failure to do so may greatly affect the outcome of our electronic device design.

The current study focuses on applications of several computational electromagnetics methodologies to electromagnetic systems. The following are examples of examples to current technology:

1. Adaptive mesh refinement is essential in the study of small discontinuities such as an iris or a thin slot. To adequately model the behavior in these regions, the discretization must be on the order of the size of the discontinuity.
2. An alternative to adaptive mesh refinement may be the use of non-standard mesh element configurations. In thin-layer regions with high field activity, standard discretization configurations such as triangle mesh elements for two-dimensional problems and tetrahedral mesh elements for three-dimensional problems may be replaced by configurations which more easily conform to the geometry of interest.
3. Research topics may be applied in the characterization of advance material layer properties for thin-layer metallized membranes and meshes which are subsequently used for shielding. This may require first obtaining experimental results for reflection and transmission coefficients and using this information to determine permittivity and permeability of material layers.

Laser-Assisted Stir Welding of 25-mm-Thick HSLA-65 Plate

Keith M. Williamson, Ph.D
Old Dominion University
Department of Mechanical Engineering

Laser-assisted stir welding is a hybrid process that combines energy from a laser with frictional heating and mechanical energy to join materials in the solid state. The technology is an adaptation of friction stir welding which is particularly suited for joining thick plates. Aluminum plates up to 75 mm thick have been successfully joined using friction stir welding. Since joining occurs in the solid state, stir technology offers the capability for fabricating full penetration joints in thick plates with better mechanical properties and less weld distortion than is possible by fusion processes. Currently friction stir welding is being used in several industries to improve productivity, reduce weight, and increase the strength of welded structures. Examples include: (a) the aircraft/ aerospace industry where stir technology is currently being used to fabricate the space shuttle's external tank as well as components of the Delta family of rockets; (b) the shipping industry where container manufacturers are using stir technology to produce lighter containers with more payload capacity; and (c) the oil industry where offshore platform manufacturers are using automated stir welding plants to fabricate large panels and structures up to 16 meters long with widths as required. In all these cases, stir technology has been restricted to aluminum alloys; however, stainless and HSLA 65 steels have been recently stir welded with friction as the primary heat source.

One of the difficulties in adapting stir welding to steel is tool wear aggravated by the high tool rubbing velocities needed to provide frictional heat input into the material. Early work showed that the tool shoulder reached temperatures above 1000°C and the weld seam behind the tool stayed within this temperature range for up to 25 mm behind the tool. Cross sections of stir welded samples showed that the heat-affected zone is relatively wide and follows the profile of the tool shoulder. Besides minimizing the tool wear by increasing the energy into the material, another benefit of the proposed *Laser Assisted Stir Welding (LASW)* is to reduce the width of the heat affected zone which typically has the lowest hardness in the weld region. Additionally, thermal modeling of the friction stir process shows that the heat input is asymmetric and suggests that the degree of asymmetry could improve the efficiency of the process. These asymmetries occur because the leading edge of the tool supplies heat to cold material while the trailing edge provides heat to material already preheated by the leading edge. As a result, flow stresses on the advancing side of the joint are lower than corresponding values on the retreating side. The proposed *LASW* process enhances these asymmetries by providing directional heating to increase the differential in flow stress across the joint and improve the stir tool efficiency.

Theoretically the *LASW* process can provide the energy input to allow the flow stresses on the advancing side to approach zero and the stir efficiency to approach 100 percent. Reducing the flow stresses on the advancing side of the weld creates the greatest pressure differential across the stir weld and eliminates the possibility of voids on the advancing side of the joint. Small pressure differentials result in poor stir welds because voids on the advancing side are not filled by the plastic flow of material from the retreating side.

UNIPASS for AvSP? A Broader View

**N. Eva Wu
Department of Electrical Engineering
Binghamton University
Binghamton, NY 13902-6000
E-mail: evawu@binghamton.edu**

The goal of the NASA Aviation Safety Program (AvSP) is to reduce the fatal aircraft accident rate by 80 percent in 10 years, and by 90 percent in 25 years^[1]. One of the six project areas in AvSP is the Single Aircraft Accident Prevention (SAAP) project. A key challenge of implementing newly developed safety enhancement technologies into the aircraft fleet is the validation and certification of these highly complex integrated and adaptive systems. Reliability analysis, in conjunction with simulation, flight test and laboratory test, plays a central role in addressing the issue of system validation and certification. UNIPASS^[2] is a general-purpose probabilistic computer program that has the potential for being adopted as a tool for reliability analysis in the AvSP in order to aid the process of validation and certification.

The tasks at hand are to understand the underlying theory upon which UNIPASS is built as a reliability assessment tool, to determine the utility of UNIPASS in the AvSP, and to compare the capabilities of UNIPASS to other known software tools that have been used in the AvSP, more specifically, WinASSIST and WinSURE^[3].

UNIPASS can perform the following three functions.

- (1) Failure probability computation for components and simple systems given the joint probability distribution of the root causes affecting the component state, and the limit state function that defines the boundary between the failure domain and safe domains.
- (2) Sensitivity analysis of failure probability and reliability index for single components with respect to physical variables and their means and standard deviations.
- (3) Estimation of probability density functions of limit state functions for single components.

Although it was not in the originally intended applications scope of UNIPASS, an attempt was made through some creative problem formulation to use the tool for fatigue life prediction of a system with a degradable two-layer parallel-to-series configuration. It was found that UNIPASS is not as efficient and accurate as WinASSIST and WinSURE in predicting the life of a complex system, and it is incapable of handling system reconfiguration. On the other hand, since the reliability modeling of UNIPASS is based on the physics of failures, rather than statistics, it can be used to obtain a more accurate component failure model, if the limit state function can be established for the component with sufficient accuracy. These more accurate component failure models can help identify the needs and the potential for component reliability enhancement, and model dynamic failure processes through the covariate method.

[1] Christine Belcastro and Celeste Belcastro, "Application of Fault Detection, Identification, and Accommodation Methods for Improved Aircraft Safety", *Proc. American Control Conference*, 2001.

[2] UNIPASS Technologies, "UNIPASS Version 3.10", 1999-2001.

[3] Ricky Butler and Sally Johnson, "Techniques for modeling the reliability of fault-tolerant systems with the Markov state-space approach", NASA Reference Publication 1348, 1995.

Modeling for Airframe Noise Prediction Using Vortex Methods

Z. C. Zheng, Ph.D.

Department of Mechanical Engineering

University of South Alabama

Mobile, AL 36688

E-mail: zzheng@mne.ksu.edu

Various components of the airframe are known to be a significant source of noise. With the advent of technology in quieting modern engines, airframe generated noise competes and, in certain instances, surpasses the engine noise. Airframe noise is most pronounced during aircraft approach when the engines are operating at reduced thrust, and airframe components such as high-lift devices and landing gears are in deployed conditions. Recent experimental studies have reaffirmed that the most significant sources of high-lift noise are from the leading-edge slat and the side edges of flaps. Studies of flow field around these structures have consistently shown that there are complicated unsteady vortical flows such as vortex shedding, secondary vortices and vortex breakdown, which are susceptible to far-field radiated sound. The near-field CFD computational data have been used to calculate the far-field acoustics by employing Ffowcs-Williams/Hawkings equation using Lighthill's analogy.

However, because of the limit of current computing capacity, it is very time consuming to generate unsteady Navier-Stokes (N-S) computational data for aeroacoustics. Although the N-S simulations are probably necessary to reveal many complex flow phenomena that are unsteady and fully nonlinear, these simulations are not feasible to be used for parametric design purposes. The objective of this study is thus to develop theoretical models for airframe noise predictions which have quick turn-around computing time. Since it is known that vorticity is a major mechanism responsible for noise generation on high-lift devices, vortex methods have been chosen as modeling tools. Vortex methods are much faster in comparison with other numerical methods, yet they are able to incorporate nonlinear interactions between vortices. Obviously, as with any theoretical model, assumptions have to be made and justified when such models are used in complex flow. The merit and applicability of the models for aeroacoustics applications will be investigated. Issues related with conservation of vorticity, unsteady Kutta conditions and nonlinear frequency response to vortex shedding will be addressed.

Thermal/Mechanical Response and Damage Growth in Polymeric Matrix Composites at Cryogenic Temperatures

Han Zhu, Assistant Professor
Civil and Environmental Engineering Department
Arizona State University, Tempe, AZ 85287-5306

August 3, 2001

The next generation of space transportation systems may require both reusable launch vehicles (RLVs) and expendable launch vehicles (ELVs) to satisfy mission requirements. Regardless of the vehicle type, these new space transportation vehicles will require advances in lightweight structural materials and design to meet the increased demands on performance. One potential source for significant structural weight reduction is the replacement of traditional metallic cryogenic fuel tanks with new designs for polymeric matrix composite (PMC) tanks.

The research is undertaken to help understand this problem of damage development in cryogenic environments and relate this data to material permeability. Specifically, the experimental results provide data on the residual mechanical properties and damage state of a high-performance PMC tested at cryogenic temperatures and pre-conditioned using combinations of mechanical and thermal loading. This data was then used as both input to and verification of a thermal/mechanical analysis of composite laminates for a range of loading conditions and laminate configurations. The study presented here then aims to correlate changes in material properties with the development of microcracks in a PMC material subjected to an extreme environment.

Materials characterization and the development of data that leads to an understanding of the damage mechanisms of PMC's at cryogenic temperatures requires the appropriate test methods suitable for extreme environments. One method, for example, is to load coupons in tension while undergoing a temperature change from room temperature to -269°C . The test program evaluated residual stiffness and strength properties as a function of both cryogenic test temperatures and pre-test cryogenic aging conditions and damage, as measured by microcrack density, was quantified at each stage of the test program. The test specimens were made of a carbon fiber polymeric matrix composite, IM7/PETI-5, and five different specimen ply lay-ups were chosen for study. These five ply lay-ups were $[0]_{12}$, $[90]_{12}$, $[\pm 45]_{3s}$, $[\pm 65]_{3s}$, and $[45, 90_3, -45, 0_3, -45, 90_3, 45]$. It was recognized that a broad spectrum of factors influence the development of damage in PMC's including material selection, composite fabrication and handling, aging or preconditioning, specimen preparation, laminate layup, test procedures, etc. This study will focus on preconditioning methods and laminate configuration as the primary test variables. Coupon specimens are isothermally aged first and then received the mechanical load till they fail. Matrix cracks are optically observed in those coupons, and the crack density is evaluated by counting crack numbers over per inch length. The information of crack density will provide the understanding and quantification of how the temperature and mechanical load may change the performance of composites in a cryogenic environment.

APPENDIX VIII
2001 ASEE PROGRAM ORIENTATION EVALUATION REPORT

2001 ASEE PROGRAM ORIENTATION EVALUATION REPORT

(Twenty-nine Orientation evaluations were returned - 81%.)

1. Was the Orientation notification received in a timely manner?

1 - Poor - 0%	4 - Good - 6 (21%)
2 - Fair - 0%	5 - Excellent - 20 (69%)
3 - Average - 1 (3%)	No Answer - 2 (7%)

2. Were the meeting facilities adequate?

1 - Poor - 0%	4 - Good - 6 (21%)
2 - Fair - 0%	5 - Excellent - 23 (79%)
3 - Average - 0%	

3. Was the Welcome Package beneficial?

1 - Poor - 0%	4 - Good - 7 (24%)
2 - Fair - 0%	5 - Excellent - 22 (76%)
3 - Average - 0%	

4. How do you rate the Program Breakout Session?

1 - Poor - 0%	4 - Good - 7 (24%)
2 - Fair - 0%	5 - Excellent - 22 (76%)
3 - Average - 0%	

5. Was the information and knowledge gained at the Orientation helpful?

1 - Poor - 0%	4 - Good - 12 (41%)
2 - Fair - 0%	5 - Excellent - 16 (55%)
3 - Average - 1 (3%)	

6. In general, how do you rate this Orientation?

1 - Poor - 0%	4 - Good - 8 (28%)
2 - Fair - 0%	5 - Excellent - 21 (72%)
3 - Average - 0%	

7. Comments:

-Some information was repeated (Safety & Hygienist). Mr. Capino should define export control at the start of his talk. The speakers were rushed. A handout of their major points would be helpful. However, overall it was excellent in what was accomplished. - Sound volume for security session too high. Use of overhead slides was excellent. - The addition of Export Control Briefing to the program was very timely and should be appreciated by all who care about this country. - The prior e-mails were very helpful. - Having done this before, most of the material was not new. - Did not receive e-mail or packet. - The Orientation was very helpful in its current format. - Difficult to hear the speakers. Ask for cell phones to be turned off. - I received my packet only a couple of days before I left. Mr. Prior's LaRC Overview was especially helpful. It would have been nice to know about the ASEE ice-breaker on the first day before showing up. That way family would have some idea when I'd return.

APPENDIX IX
POLICIES, PRACTICES, AND PROCEDURES MANUAL

**NASA LANGLEY AMERICAN SOCIETY FOR
ENGINEERING EDUCATION (ASEE) SUMMER
FACULTY FELLOWSHIP PROGRAM**

2001

POLICIES,

PRACTICES,

and

PROCEDURES

MANUAL

A Handbook for ASEE SFFP Fellows

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Introduction

Since 1964, the National Aeronautics and Space Administration (NASA) has supported a program of summer faculty fellowships for engineering and science educators, whereby faculty members spend 10 weeks working with professional peers on research.

The ASEE program is administered by a collaborating university. Either a Co-Director from Old Dominion University (ODU) or Hampton University (HU), on alternate years, works with the NASA Langley Research Center (LaRC) University Affairs Officer, who is the Technical Monitor.

The faculty member will participate in three primary elements of the ASEE program which are: (1) a research project in cooperation with a NASA associate, (2) a study program consisting of technical lectures and seminars given by distinguished scientists and engineers from NASA, academia, or industry presented to program participants, and (3) a technical presentation and paper. Additional elements of this program include tours of LaRC wind tunnels, computational facilities, and laboratories. Library and computer facilities will be available for all participants.

The objectives of the program are: (1) to further the professional knowledge of qualified engineering and science faculty members, (2) to stimulate an exchange of ideas between teaching participants and employees of NASA, (3) to enrich and refresh the research and teaching activities of participants' institutions, and (4) to contribute to the research objectives of the Center.

The Policies, Practices, and Procedures Manual sets forth the conditions of your award, your responsibilities as an ASEE Fellow, and the procedures observed by the universities and the LaRC's Office of Education (OEd) in supporting and implementing your summer research program.

1.0 Definitions

1.1 ASEE Summer Fellow

As an ASEE Summer Fellow you are a faculty member, competitively selected by the LaRC Competencies in a national competition, who has been offered a fellowship to perform scholarly research on a problem of interest to NASA in the ASEE Summer Faculty Fellowship program.

You enjoy the status and privileges of a guest summer faculty Fellow at LaRC. You are not an employee of LaRC or the sponsoring Competency and do not perform personal services for either organization.

1.2 Langley Research Center

For the purposes of the ASEE Program, the terms “Center” and “LaRC” are used to refer to NASA’s Langley Research Center.

1.3 ASEE Associate

An ASEE associate is the scientist, engineer, or other program support person at the Center with whom you will work most closely. All matters relating to your research program will fall under his or her purview. The associate also assists, as needed, in securing space, equipment, or technical support.

1.4 ASEE Co-Director

The ASEE Co-Director from Hampton University (HU), working in conjunction with the LaRC University Affairs Officer as Technical Monitor, is responsible for the proper administration of the ASEE program. The Co-Director is available to discuss all aspects of the program with you, and he is your prime contact person in the OEd.

1.5 ASEE Program Manager/Administrative Assistant

The ASEE Program Manager/Administrative Assistant is a support-staff member who works closely with the ASEE Co-Director in the administration of the program, and acts as his representative in his absence. The Program Manager/Administrative Assistant is also available to answer any questions.

1.6 Approval

Throughout this handbook, various procedures are cited that require the exclusive approval of the Co Director. The use of the word “approval” means written approval. Any document requiring the Co Director’s approval must have the concurrence of the appropriate associate. Any actions taken on the basis of verbal concurrence are not binding on the Co-Director unless followed by appropriate written authorization.

2.0 Accepting a Fellowship and Beginning Tenure

2.1 Notification of a Fellowship

You will be notified of your ASEE Fellowship by an official selection letter that states the conditions of your fellowship, information concerning your stipend, and the period of your tenure at LaRC which will be for 10 weeks.

2.2 Acceptance Information

Once you receive your selection package, and as a follow-up to your verbal acceptance, please return your written acceptance of the fellowship not later than the date specified in your award letter.

If you are requesting an alternate start or end date, please do so in your acceptance letter. The approval of both the Co-Director and the Competency with whom you will be working is required before your tenure may officially begin. These approvals are necessary to ensure compliance with the Center's scheduling of research and its availability of support facilities.

You must also return the completed ASEE Personnel Security Paperwork and any other requested items in order to facilitate a security background check.

2.3 Information Package

Included with your selection letter is an Information Package. The purpose of this package is to provide you with information which will facilitate your stay at LaRC. Included in this package is the following:

- (a) Policies, Practices, and Procedures Manual and Signature Form
- (b) NASA ASEE Personnel Security Paperwork Package
- (c) NASA Fact Sheet
- (d) Map of the Area
- (e) Directions to NASA
- (f) Housing Information
- (g) Activities Interest Survey
- (h) Federal Regulation Form
- (i) NASA Education Evaluation Program Release Form

2.4 Working with the ASEE Associate

You are expected to maintain close contact with your assigned associate who will offer guidance in all aspects of your technical activities and assistance in acquiring research support facilities.

2.5 Change of ASEE Associate

If for any reason your assigned ASEE associate changes, you and the associate must notify the Co Director immediately in writing. The change will not be effective until the Co-Director and OEd have concurred with the request.

2.6 Conforming to Center Policies

ASEE Fellows are expected to conform to all established policies and procedures of the sponsoring Center as they pertain to guest researchers and the safety and health of individuals working at the Center.

2.7 Extensions of Tenure

There will be no paid extensions of tenure. The only exception is at the sole discretion and written approval of the Co-Director. In order for him to consider an extension, he must receive a written memorandum submitted by the LaRC associate. This memorandum must outline the critical need for the extension well in advance of the program end date. At that point, the Co-Director will consider the request and may approve depending on funding availability.

3.0 Stipend

3.1 Federal Funding Regulation

*****Please Note: Fellows must understand that it is illegal to receive stipend or salary payments from other Federal funding sources including research grants and contracts while participating in a government- sponsored summer faculty fellowship. Failure to comply with this regulation may, at a minimum, result in termination of your fellowship. In addition, you may want to check the regulations at your institution regarding receipt of supplemental funding.*****

3.2 Stipend Amount

The amount of your stipend is \$1,000 per week. Stipends are paid on the basis of a 5-day, 40-hour work week; and are issued biweekly, beginning the third Tuesday of the ASEE program (actual stipend payment schedule provided upon arrival). Therefore, all ASEE Fellows should be prepared to provide for themselves financially the first 2 weeks of the program (Refer to Section 4.0).

3.3 Acceptance Letter

Your acceptance letter must be received before stipend payments can be authorized.

3.4 Locator Form

In the orientation package you receive on the day of your arrival, you will receive a Locator Form. This form must be completed and returned to the Program Manager/Administrative

Assistant as soon as possible following your arrival. On this form, you will be requested to supply your local address and phone number, a person to contact in case of an emergency, and your actual physical location on Center, including Mail Stop, building address, building number, room number, and extension. Once this form has been turned in, this office must be notified immediately if any changes are made.

3.5 Receiving Stipend Payments

Your biweekly stipend payments are not available for deposit by electronic funds transfer (EFT). They must be picked up in person from the ASEE Program Manager/Administrative Assistant. In order to receive your stipend payment, you must bring your badge for proof of identification and sign the form confirming receipt of payment.

Final stipend payment will be made only after you have submitted your Final Abstract, the Program Questionnaire, the Final Report Forms, the Final Checkout Form with appropriate signatures, your badge and pass, and any additional information required. If you will not be on Center the last day when stipend checks are available, submit to the Co-Director a signed memo indicating the address to which your check is to be mailed if different from your permanent home address.

3.6 Cashing Your Stipend Checks

Bank of America/SunTrust: Your stipend checks are cut from either Bank of America or SunTrust and you may cash it at any of their branches free of charge.

Langley Federal Credit Union (LFCU): LFCU offers check cashing privileges for a fee. Due to their policy, you will be unable to open an account or cash personal checks.

4.0 Relocation Allowance and Travel

4.1 Relocation Allowance

A relocation allowance of \$1,000 will be provided to any Fellow who is required to relocate their residence because their home and school address is more than 50 miles from NASA Langley Research Center. This is provided to assist in the additional expenses incurred in relocating to the Tidewater area. No receipts are required.

4.2 Travel Reimbursement

Fellows are reimbursed for their travel under the following terms:

- Round trip coach air fare (receipt required) or,

- Round trip mileage up to the cost of coach air fare, maximum \$500.

Meals and overnight accommodations are the Fellow's responsibility. A travel expense form will be provided in your welcome package and should be filled out and returned to the Program Manager/Administrative Assistant at the Orientation in order to ensure prompt processing. Both the relocation allowance and travel reimbursement will be provided at the next pay date following submission of your information if time allows.

5.0 Insurance

5.1 Health and Medical Insurance

It is the responsibility of the ASEE Fellow to have the appropriate health and medical insurance coverage. The ASEE program does not provide any insurance coverage. Experience has shown that coverage for you and your dependents is extremely beneficial. Unless you already have insurance coverage, you are advised to weigh carefully the cost/risk factor in reaching a decision to participate in this program.

5.2 Worker's Compensation Type Insurance

ASEE Fellows are not covered by any type of Worker's Compensation Insurance through the ASEE program. If injured while on duty, however slight, immediately notify your associate and the Co Director at (757) 864-5215. Emergency medical assistance can be obtained from the Occupational Health Services Clinic, Building 1149, from 7:00 a.m. to 3:30 p.m. In a medical emergency, dial 911.

5.3 Automobile Insurance and Driver's License

You must have a valid driver's license, automobile insurance, and a current inspection sticker to certify that your automobile is safe and to be issued a Vehicle Pass to drive on-Center.

6.0 Taxes

6.1 Federal Tax Liability of United States Citizens

Since you are not an employee of NASA LaRC or ODU, but are an ASEE Fellow and considered self employed, neither the OEd nor ODU withholds taxes from stipend payments to you. You will receive from the university, a form 1099 indicating your total stipend.

You should refer to the pertinent tax publications and plan ahead to meet any tax obligations, both federal and state, if applicable, and file your returns as required by Federal law. The

responsibility for the payment of your income taxes rests solely with you. The OEd and ODU cannot provide information or consultation concerning income taxes.

6.2 Social Security Taxes

Since you are not an employee of NASA LaRC or ODU, but are an ASEE Fellow and considered self employed, neither the OEd nor ODU withholds Social Security Taxes from your stipend payments. You should refer to the pertinent publications on Social Security Taxes to determine whether you have incurred any tax obligation. Although Social Security Taxes are not withheld from stipend payments, you are nonetheless required to have an assigned Social Security Number.

6.3 State Tax Liability

You may be liable for state income taxes and should file the appropriate tax return in compliance with the laws of the state in which you reside. You should consult a local government tax authority at the beginning of tenure for further details concerning this liability.

7.0 Leave

7.1 Leave

As a guest researcher in the 10-week ASEE Program, you are not eligible for annual leave, sick leave, or personal leave.

If there are reasons why you need to be absent from work during the summer research experience, there are a few steps you must take prior to the absence. First, you must clear this absence with your LaRC associate. Next, submit a memo to the ASEE Co-Director with your associate's concurrence requesting approval for your absence. This is to include any conferences or presentations of papers. If this absence is directly related to your summer research and a memo to that effect is submitted by your associate, then time approved can be considered a part of your 10 week tenure. If you are approved to attend a conference not related to your summer research, then the time away must be made up before receiving your final stipend check. If you are aware, prior to the start of the summer program, of a meeting or conference you desire to attend during the 10-week period, we ask that you request approval for this absence as soon as possible to allow for timely processing.

7.2 Work Hours

The typical work schedule is from 8 a.m. to 4:30 p.m. Once you arrive on Center, you will need to conform to the schedule applicable to your Branch, as schedules may vary.

7.3 Working After Hours

After hours access and work at LaRC after 6 p.m. require an authorized LaRC badged escort. Unescorted after hours work is discouraged; however, in special situations in order for you to work after hours several steps must be taken. You must first have the approval of your LaRC associate sponsor. Your associate must submit to the Security Management Office (SMO) a Request for Unescorted After Hours Access (Langley Form 218) for you to work unescorted after hours. Also, a favorable background check and investigation must be completed on you by the SMO before unescorted after-hours access is granted. Should after hours access seem necessary, both you and your associate should be aware that the extended security process will take up to three months. This information is subject to change.

8.0 Housing

8.1 Housing Package

The ASEE Office provides information on short-term leasing to those Fellows who require housing while in the ASEE Program. Included with your award letter is a Housing Package with pertinent information.

8.2 Disclaimer

It is the Fellow's responsibility to contact the apartment complex, etc., to finalize all housing arrangements. You are strongly encouraged to make these arrangements as early as possible since short term leases are in great demand during the summer due to the influx of people into the area. Neither ASEE, NASA, ODU, nor any staff representatives shall intercede in the lease agreement made between the tenant and the landlord. This information is provided for the sole purpose of assisting you in making your transition to the Tidewater area easier. Once again, the only form of financial assistance provided for your housing is the relocation allowance (See Section 4.1). It is recommended that as soon as you know your departure date, you submit this information in writing to the complex management.

9.0 Lecture Series

9.1 Attendance

Weekly attendance at the Lecture Series by all Fellows is strongly encouraged. The purpose of the Lecture Series is to expand the knowledge of the professors with hopes of enhancing their classroom teaching and to give a greater knowledge of NASA's special research activities being conducted at the Center.

9.2 Distribution of Information

The weekly Lecture Series will also be used as an avenue to distribute pertinent program information, including stipend checks.

10.0 Activities Committee

A voluntary activities committee will be formed at the onset of the program. This committee will plan various after work activities for the Fellows and their families. Participation in any activity is solely on a voluntary basis, and neither NASA nor ODU assume any responsibility for any events.

11.0 Security and Center Access Requirements

11.1 Personnel Security Screening Requirements

As a prerequisite for employment and access to NASA Langley Research Center (LaRC) facilities, programs and information, all participants in the American Society for Engineering Education (ASEE) Summer Faculty Fellowship program at LaRC are required to complete the Personnel Security Screening Forms (NASA Form 531, "Name Check Request," OPM Optional Form 306, "Declaration for Federal Employment," and FCRA Credit Release Authorization Form), which are included in your Information Package. All forms are to be completed, per the LaRC Security Office instructions, and returned to the address listed below 45 days prior to reporting to work at NASA LaRC. Completed forms are to be mailed to NASA Langley Research Center, ATTN: Mrs. Debbie Murray, MS 400-ASEE, 17 Langley Blvd., Hampton, VA 23681-2199.

11.2 LaRC Access Requirements

A LaRC issued Photo Identification Badge is required for access to the Center. This badge permits ASEE Summer Faculty Fellowship program participants unescorted access to the Center during normal duty hours only. Normal duty hours at LaRC are from 6 a.m. to 6 p.m., Monday through Friday. Access during other than normal duty hours must be under escort. (See Section 7.3 Working After hours)

11.3 ASEE Summer Employee Orientation

Upon initial arrival at NASA LaRC, all ASEE Summer Faculty Fellowship program participants will attend a special ASEE Summer Employee Orientation session at the Reid Conference Center. When entering the Center on initial entry day, inform the Security Officer on duty at the LaRC Main Gate that you are an ASEE Summer Faculty Fellowship program

participant and here to attend the ASEE Summer Employee Orientation session at the Reid Conference Center. The Security Officer will direct you to the Conference Center.

11.4 Identification Badges and Vehicle Passes

A 5-day Temporary LaRC Identification Badge will be issued to ASEE Summer Faculty Fellowship program participants at the ASEE Summer Employee Orientation session. ASEE program participants must then report to the Main Gate Badge & Pass Office within 5 working days after the orientation to receive their extended Temporary LaRC Photo Identification Badge and Vehicle Pass. A valid driver's license or other authorized photo identification is required for issuance of a LaRC Identification Badge and Vehicle Pass. NOTE: Before a LaRC Identification Badge can be issued, however, the completed Personnel Security Screening Forms must have been submitted through the Office of Education to the Security Office.

LaRC identification badge must be worn and in full view at all times while on Center. If LaRC identification badge is forgotten, lost or stolen, report immediately to the Badge and Pass Office at Bldg. 1228 for issuance of a temporary replacement badge.

11.5 Checkout Requirements

At the end of your work assignment, ASEE Summer Faculty Fellowship program participants are required to check out through the Office of Education and turn in their LaRC Photo Identification Badge and Vehicle Pass at that time. For additional security information and questions, contact the LaRC Security Management Office at 757-864-3420 or 757-864-2790.

12.0 Safety

12.1 Safety Program

The objective of this program is to ensure each Fellow a safe and healthful working environment that is free from unacceptable hazards which could result in property damage, injury, or loss of life. The Langley Safety Manual is a compilation of documents which sets forth procedures pertinent to the safety operations of the Langley Research Center.

Each facility/building has a designated Facility Safety Head and Facility Coordinator (published in the LaRC Telephone Directory) responsible for ensuring adherence to safety rules and regulations.

12.2 Hazardous Communications Training

All Fellows are required to receive Hazardous Communications Training. This training provides awareness of dealing with chemicals which are physical or health hazards.

12.3 Safety Clearance Procedures

These procedures are used to ensure personnel or equipment safety during installation, maintenance, or in any situation where an equipment configuration must be temporarily maintained for the protection of personnel or equipment. The red tag may be placed upon any device which could, if actuated, cause personnel or property to be endangered. The red tag may also be used to forbid entrance to dangerous areas.

No person, regardless of position or authority, is to operate any switch, valve, or equipment which has a red tag attached to it, nor will such tag be removed except as directed by an authorized authority.

12.4 Accident Reporting

Fellows shall immediately report all job related accidents, injuries, diseases or illnesses to their associate, the Co-Director, and the Office of Safety and Mission Assurance (OSMA), 757-864-SAFE (757-864-7233). Emergency medical assistance can be obtained from the Occupational Health Services Clinic, Building 1149, from 7:00 a.m. to 3:30 p.m. In a medical emergency, dial 911.

12.5 Personnel Certification

It is LaRC policy to certify Fellows performing tasks which could be potentially hazardous to either the individual or co-workers. These requirements vary with the type of activity being performed, and consequently are described in detail in the LaRC Safety Manual dealing with the specific topic/hazard. Particular research assignments may require training, certification, and medical surveillance requirements. Examples of these types of research assignments are chemical, radiation and/or pyrotechnic operations.

13.0 Mail Center

13.1 Official Mail

The LaRC mail system is only to be used for official mail. All offices are assigned a Mail Stop to which mail is routed. ASEE Fellows typically share a Mail Stop with their associates. One mail delivery is made each day to in/out boxes located near the mail stop

custodian. Distribution of packages and boxes which are too large for internal mail distribution are made to a designated table located in each facility.

Messenger envelopes are used to send mail internally. Before placing the envelope in the mail system cross out the previous name and Mail Stop, fill in the addressee's name and Mail Stop. Internal mail cannot be delivered without a Mail Stop.

If you change your work site, it is your responsibility to complete NASA Langley Form 41, "Langley Research Center (LaRC) Directory Change Notice," (located in the back of the Langley Telephone Directory). This form is used to place your name on internal mailing lists, and it is necessary that this information be kept up-to-date.

13.2 Personal Mail

Personal mail may be placed in the U.S. Post Office boxes located in front of the Cafeteria. Additionally, the Langley Exchange Shop, located in the cafeteria, will mail your personal packages.

13.3 Additional Items to Remember:

- Do not use official Government envelopes for personal mail.
- For fastest delivery by the post office: address envelopes in all capital letters, no punctuation, use state abbreviations, and zip code.
- Each piece of mail requiring postage must be stamped with the mail stop of the originating organization for identification.
- Do not use NASA Langley Research Center as a mailing address for personal mail.
- Do not send personal mail (cards, chain letters, job resume, etc.) in the internal mail delivery system.
- When addressing messenger envelopes, use first and last name. Do not use nicknames.
- Do not use room numbers in place of mail stops on messenger envelopes.
- Mail Stops are required for delivery of internal mail.

If you have any questions, please call the Mail Manager, 757-864-8159.

13.4 Electronic Communications

The LaRC telephone, fax, and electronic mail system is to be used for official use only. LaRC conducts random monitoring of telephone lines and all electronic mail systems for unauthorized use. If you have any questions, please call the Network Support Office at 757-864-7777.

14.0 Library

The Technical Library serves the information needs of the NASA Langley personnel with its Technical Information Specialists, information systems for user desktop access, on-site collection, and access to worldwide resources and databases. The library is aggressively dedicated to maximizing the desktop delivery of pertinent, customized information databases, products and services.

Currently the library holds a comprehensive collection of materials in both print and electronic formats, covering the areas of aeronautics, structures and materials, space science, atmospheric sciences, and management. This includes 70,000 books, 800 journal subscriptions, over 2 million technical reports and access to more than 500 commercial and government electronic databases. At present, the library's information systems include NASA Galaxie, an on-line catalog; a CD-ROM database network; Electronic Journals; NASA Research Connection (RECON); and current awareness services. Most of these are accessible through the Technical Library homepage located on the WWW at <http://library-www.larc.nasa.gov>.

To attain access to library services and computer systems, participants must be listed on the official American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program roster issued by the OEd. Basic services include loan of books and documents, access to the library's on line systems, and literature searches by Information Specialists. ASEE participants must return all loaned materials to the library 2 weeks prior to the conclusion of the program. If materials are not returned, there will be a delay in receipt of the final stipend check. Lost items must be replaced before participant's library account is cleared.

15.0 Cafeteria

15.1 NASA Exchange Cafeteria

Locations:	16 Taylor Drive, Building 1213 and 5 North Dryden, Building 1202
Hours of Service:	Monday through Friday
Breakfast:	6:15 a.m. - 8:30 a.m. - Main Cafeteria only

Lunch: 10:45 a.m. - 1:30 p.m.
Holidays: Closed

15.2 Additional Items to Remember

Busiest Time: 11:30 a.m. to 12:15 p.m.

Reservations: None Taken between 11:30 a.m. - 12:30 p.m.
Large groups after 12:30 p.m.

15.3 Check Writing Policies

Checks are accepted from badged summer program participants for amount of purchase only.

15.4 Area Tickets Available

Discount tickets for Busch Gardens, Water Country, Kings Dominion, AMC and Regal Theaters, and Colonial Williamsburg can be obtained at the Exchange Shop in the Cafeteria. If you are interested in tickets, call 757-864-1585.

16.0 H.J.E. Reid Conference Center

16.1 Conference Center

The Conference Manager serves as a consultant and advisor for conferences and technical meetings. Reservations can be made for the following locations:

H.J.E. Reid Conference Center (Auditorium, Langley, Hampton, and Wythe Rooms)
14 Langley Boulevard

Pearl I. Young Theater
5A N. Dryden Street

Executive Conference Center (Rooms 107, 205, & 209)
3 S. Wright Street

7 X 10 Facility - Room 200
17 W. Taylor Road

Call 757-864-6362 for reservations.

16.2 Picnic Shelters

There are two picnic shelters on the grounds of the Reid Conference Center that can be reserved for office picnics. For reservations, call 757-864-6369.

16.3 NASA Gym

The NASA Gym is open from 11 a.m. to 1 p.m. Tuesday and Thursday, and 12:00 noon to 1:30 p.m. Monday, Wednesday, and Friday. Also, there is a free aerobics class from 11:00 a.m. to 11:45 a.m. Monday, Wednesday, and Friday.

The Langley Activities Association sponsors Bingo on Thursday nights, a Social Hour every other Friday evening, and a dance every other Saturday evening beginning at 7 p.m.

16.4 LaRC-sponsored clubs:

Aerobics Club	Amateur Radio Club
Astronomy Club	Apiculture Club
Basketball League	Bicycle Safety Club
Bowling League	Conservation Club
Flag Football	Garden Club
Golf Association	Karate Club
Radio Model Club	Runners Club
Science Fiction Club	Softball League
Tennis Club	Volleyball League

16.5 Additional Information

If you would like to see exhibits on NASA or view a featured film in an IMAX theater, you can visit the Virginia Air & Space Center in downtown Hampton.

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